DOCUMENT RESUME

ED 386 109 HE 028 517

AUTHOR Allen, Dave; And Others
TITLE Compendium of Selected Papers from the 1994 TAIR Conference and 1993 Best Paper.
INSTITUTION Texas Association for Institutional Research.
PUB DATE Jul 94
NOTE 87p.; Papers presented at the Annual Meeting of the Texas Association for Institutional Research (16th, El Paso, TX, February 23-25, 1994).
PUB TYPE Collected Works - General (020) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *College Athletics; Educational Research; Educational Trends; *Enrollment; Followup Studies; Higher Education; *Information Needs; *Institutional Research; Needs Assessment; Research Methodology; *School Holding Power; Sex Differences; Trend Analysis; *Universities
IDENTIFIERS *Texas

ABSTRACT

This collection of five papers focuses on institutional research of interest to Texas institutions of higher education. It includes: (1) "Analysis of User Data and Information Trails: An Overview of the AUDIT Approach" (Cathi Gordon and Laura Massey), which explains the use of the Analysis of User Data and Information Trails (AUDIT) to provide a practical, comprehensive approach to information needs assessment; (2) "East Texas State University Student Follow-Up Study" (Ron Huffstutler and Dennis Brandt), which discusses the use of an automated system to track student enrollment, transfer, drop-out, employment, and graduation rates; (3) "Examining Gender Equity in Athletics" (Richard W. Middaugh), which provides an overview of techniques employed in a gender equity study and the results of such a study at a comprehensive state university; (4) "Uses and Abuses of Statewide Tracking" (Dave Allen), which focuses on Angelo State University's experiences with statewide tracking of student retention and graduation; and (5) "Getting Started with Survival Analysis: An Application to Retention Data" (Sharron L. Ronco), which discusses the use of survival analysis to examine the factors which affect student enrollment and retention. Each paper contains a reference list. (MDM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 386 109

Texas Association for Institutional Research

Changing Frontiers

STRATEGIES FOR

Action

16th Annual Conference
February 23-25, 1994
Camino Real Paso del Norte Hotel
El Paso, Texas

COMPENDIUM OF SELECTED PAPERS FROM THE 1994 TAIR CONFERENCE

AND

1993 BEST PAPER

BEST COPY AVAILABLE

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Vickie C. Natale
TAIR
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

HE028 517

Compendium of Selected Papers

from the 1994 TAIR Conference

and

1993 Best Paper

Texas Association for Institutional Research

July 1994

The TEXAS ASSOCIATION FOR INSTITUTIONAL RESEARCH is a professional organization for the development and improvement of endeavors related to institutional research, planning, evaluation, and policy analysis in postsecondary educational institutions in Texas.

TAIR Officers, 1993-94

President
Mary Korfhage
University of Texas at Dallas

Vice President
Glenn W. James
Baylor University

Secretary
Sidney A. Prewitt
Baylor University

Treasurer
Lizabeth J. Elkins
Texas Woman's University

TAIR Officers, 1994-95

President
Glenn W. James
Baylor University

Vice President
Vickie C. Natale
Del Mar College

Secretary
Patricia Duhon
Lamar University - Beaumont

Treasurer
Lizabeth J. Elkins
Texas Woman's University

1994 Best Paper Committee

Mary Korfhage, Chair
University of Texas at Dallas

William Holda
Kilgore College

Teresa Isbell
Texas State Technical College - Amarillo

Jo Lynn Loyd
Amber University

Paul E. Orser, Jr.
Texas A&M University - Corpus Christi

This compendium contains selected papers from the 1994 Conference of the Texas Association for Institutional Research. The 16th annual conference was held on February 23-25, 1994, in El Paso, Texas. Concurrent session paper presentations at the conference were eligible for consideration in the selection of the TAIR 1994 Best Paper. Papers that were submitted for consideration as Best Paper are included in this compendium. The 1994 Best Paper Committee selected *Examining Gender Equity in Athletics*, by Richard W. Middaugh, as the TAIR 1994 Best Paper.

In this first edition of a TAIR compendium, the Best Paper from the 1993 TAIR conference also is included.

For information about membership in the Texas Association for Institutional Research, contact Patricia Duhon, TAIR Secretary, Lamar University - Beaumont, P. O. Box 10601, Beaumont, TX 77710, (409) 880-8097.

Table of Contents

Analysis of User Data and Information Trails: An Overview of the AUDIT Approach 1
Cathi Gordon and Laura Massey

East Texas State University Student Follow-Up Study 6
Ron Huffstutler and Dennis Brandt

TAIR 1994 Best Paper: Examining Gender Equity in Athletics 23
Richard W. Middaugh

Uses and Abuses of Statewide Student Tracking 39
Dave Allen

* * *

TAIR 1993 Best Paper: Getting Started With Survival Analysis:
An Application to Retention Data 59
Sharron L. Ronco

Analysis of User Data and Information Trails: An Overview of the AUDIT Approach

by Cathi Gordon and Laura Massey
Texas Woman's University

I find as impossible to know the parts without knowing the whole, as to know the whole without specifically knowing the parts. Blaise Pascal

Introduction

Although strategic planning, environmental scanning, and the information super highway were not a part of French mathematician Pascal's world in the 1600's, an on-going search for meaningful data did exist. Today, individuals working in the field of institutional research continue on this journey and are too often faced with the added challenge of an immediate need to know. An **A**nalysis of **U**ser **D**ata and **I**nformation **T**rails (referred to by the acronym AUDIT) enables the researcher to establish and follow a defined path which leads to the identification of the desired data/information.

In the book titled Practical Information Policies, Elizabeth Orna presents an information audit process designed to manage organizational information flow. While Orna's audit was theory based and information policy oriented, several elements from her work have been adapted for the AUDIT described in this paper.

AUDIT Characteristics

An analysis of user data and information trails is a systematic process designed for practical implementation and use. This process is defined by and based on the following characteristics:

-- Systems Approach - The AUDIT is based on systems theory rather than analytical methodology. Data are viewed as complex and interdependent components of a system existing in a dynamic environment.
-- Formalized Process - The AUDIT follows a formal plan. Each path within the plan is documented which results in an audit trail of the process.
-- Flexible Application - The AUDIT is applicable for any level of data. For example, an AUDIT may be conducted at the data element level where each variable is analyzed or an AUDIT may be performed at the aggregate level where a specific report is studied.
-- Evolving Methodology - The AUDIT is a continually evolving process. With each AUDIT, participants have the opportunity to refine and adjust the process to improve current and future AUDITS.
-- Result/Outcome Orientation - The AUDIT process is results oriented. The project goal is stated at the beginning of the process in conjunction with a detailed timeline for achieving that goal.

For purposes of this discussion, the three primary AUDIT participants will be referred to as the requestor, primary contact, and project committee. The requestor is the individual/department whose need for data is the catalyst for the AUDIT. The primary contact is the office/department responsible for coordinating the AUDIT project, conducting the preliminary interview with the requestor, and establishing the project committee. The project committee is comprised of the requestor, primary contact, and representatives from other offices/departments whose input is required to achieve the project goal.

Performing an AUDIT . . .

Support by top management is vital to the successful implementation of an AUDIT. It may be expressed verbally, in writing, in the form of resource allocation, through participation as a committee member, or a combination of these approaches. Once this support is obtained, the four step AUDIT process can be initiated.

Step One: Conduct a Preliminary Interview

A preliminary interview of the requestor by the primary contact is the first step of the AUDIT process. The purpose of this interview is to provide the requestor with a general understanding of the AUDIT process and to provide the primary contact with an overview of the requestor's data/information needs. As a result of this interview, project goal(s) are established, equipment and personnel needs identified, and critical deadlines defined.

Step Two: Establish a Project Committee

The project committee is comprised of individuals representing areas whose input is needed to meet the goal(s) determined in the preliminary interview. In addition to the requestor and primary contact, project committee members may include representatives from administration, faculty, and staff. Regularly scheduled committee meetings provide AUDIT participants a forum to exchange information, clarify data/information needs, establish the project timeline and determine each participant's role in providing the needed data/information.

The project committee operates as a decentralized structure with open communication channels. Communication takes place at many levels and through various mediums including person-to-person, person-to-paper, and person-to-electronic media. Thus, in addition to meetings, committee members are kept informed of the AUDIT status via meeting minutes, telephone, electronic mail, and facsimile.

Step Three: Create and Maintain Data Flow Documentation

Creation and maintenance of data flow documentation although denoted here as step three of the AUDIT, is a vital part of each step of the AUDIT process. The project goal(s) and deadlines determined in the preliminary interview are documented for reference in future steps of the AUDIT. The project timeline, meeting minutes and electronic mail messages are forms of documentation utilized by the project committee.

Data flow documentation unique to step three of the AUDIT is the Data Attribute Matrix. The attribute matrix (see Exhibit 1) is a comprehensive form which facilitates identification of data input, processing, and information output details. An attribute matrix is completed for each data element under study (if the AUDIT is being conducted at the data element level) or for groups of data elements (if the AUDIT is being performed at the aggregate level). The Data Attribute Reference Matrix (see Exhibit 2) was developed to assist individuals with completing the Data Attribute Matrix. Each cell of the reference matrix contains a question corresponding to the attribute matrix.

Completion of the attribute matrix is a collaborative effort although the requestor is responsible for completing the majority of the form. Data element priority ranking and identification of the goal supported by that element are strictly based upon the requestor's perception. However, the project committee is able to contribute details regarding data input and output flow as a result of individual and collective expertise.

Step Four: Summarize Findings and Project Future Enhancements

The completed data attribute forms provide the project committee with a comprehensive picture of the data trail. That trail consists of the data initiation (point of entry into the system), journey (transformation into information), and destination (information dissemination).

Analysis of the data trail identifies system strengths and weaknesses. While the strengths provide the foundation for meeting current and future information demands, the weaknesses may be thought of as an opportunity or catalyst for change. For example, a department may collect a particular data element on paper (strength) but that data element is not entered into the system (weakness). The AUDIT procedure provides the means to identify variables or conditions which may conflict with system efficiency.

Documentation from each step of the AUDIT process determines key points to be included in the executive summary. In addition to providing details of the AUDIT purpose and findings, the executive summary presents suggestions for future action. Supplemental materials are included which reflect the AUDIT goals and outcome. If a project goal was the development of a computer generated report, then a prototype of that report would be included. If a goal was to evaluate an existing process, then a flow chart of that process with suggested enhancements would be of interest. Thus, the executive summary serves as both a snapshot of existing system capabilities and a vision for future possibilities.

Conclusion

Individuals who are responsible for meeting the challenge of ever increasing demands for data and information may find the AUDIT a viable alternative. The four step AUDIT process is designed to provide a practical, comprehensive approach to information needs assessment. Through this self-documenting process, participants are empowered to attain a higher level of information management.

References:

Orna, Elizabeth. *Practical Information Policies - How to Manage Information Flow in Organizations*. England: Gower Publishing, 1990.

Schoderbek, Peter; Charles Schoderbek and Asterios Kefalas. *Management Systems*, 4th. ed. Illinois: BPI/Irwin, 1990.

Exhibit 1

Data Attribute Matrix

Data Element: **Priority*:**

I. General	Data Input Flow		Information Output Flow Department/College/School
	Source Detail	Processing Detail	
Dept./Office/Staff responsible			
File ID/Document ID/Report Name			
Frequency (daily, weekly, semester,...)			
Length of time data are retained			
Data format (if Colleague, refer to data dictionary)			
Hardware in use (mainframe, PC,...)			
Software in use (Colleague, Excel,...)			
Data uses (includes inside and outside department/school needs)			
Volume (average count per time period)			

II. User Valuation				
Data Ranking*	Completeness	Accuracy	Relevancy	Timeliness
Report Ranking*	Ease of Use	Clarity	Accessibility	Response Time

III. Goal(s)	Priority*
Goal supported by data element-- i.e. better recruitment of students	
How data element supports goal	

* Note: Ranking/Priority range is from (1) highest to (5) lowest.

Source: TWU, Office of Institutional Research and Statistics.

Exhibit 2

Data Attribute Reference Matrix

Data Element: **Priority*:**

I. General	Data Input Flow		Information Output Flow Department/College/School
	Source Detail	Processing Detail	
Dept./Office/Staff responsible	*Who is responsible for collecting the data (i.e. Admissions office)?*	*Who is responsible for processing the information?*	*List the office/s)person(s) responsible for receiveing, using, and distributing the information.*
File ID/Document ID/Report Name	*What is the name of the original input document/form/file?*	*Where are the data stored on the system?*	*What is the name of the screens, tables, or reports that are used to access and distribute the data both within and outside the department/college/school?*
Frequency (daily, weekly, semester,...)	*How often are these data collected?*	*What is the processing schedule for these data?*	*Detail how often these data are received, processed, and distributed. (These totals may differ-- data may be received once/semester, but distributed dozens of times per semester.)*
Length of time data are retained	*How long are these data kept on file?*	*How long are the data stored in this format?*	*How long are these data retained ? How long are surveys, ad hoc requests retained?*
Data format (if Colleague, refer to data dictionary)	*In what format are the data collected and stored (text, scantron, tape)?*	*What format is used to process and store these data?*	*What is the format used to access, use, and transmit the data?*
Hardware in use (mainframe, PC,...)	*What hardware is used to collect and store the data?*	*What hardware is used to process and store these data?*	*What hardware is used within the department/college/school?*
Software in use (Colleague, Excel,...)	*What software is used to collect and store the data?*	*What software is used to process and store these data?*	*What software is used within the department/college/school?*
Data uses	*What are the data uses at the source?*	*What are the data uses on the system?*	*List the uses of the data within the department/college/school as well as the most frequent outside uses of the data.*
Volume (average count per time period)	*How many records are originally collected?*	*How many records are processed?*	*How many data records are received, accessed, processed, and distributed? How many reports contain references to these data?*

II. User Valuation				
Data Ranking*	Completeness *Are data included for all groups?*	Accuracy *Are data reliable?*	Relevancy *Are data relevant to current need?*	Timeliness *Are data current?*
Report Ranking*	Ease of Use *Is the report well arranged for use?*	Clarity *Are data displayed in a meaningful format?*	Accessibility *Are reports made available & accessable?*	Response Time *Are data made available on a timely basis?*

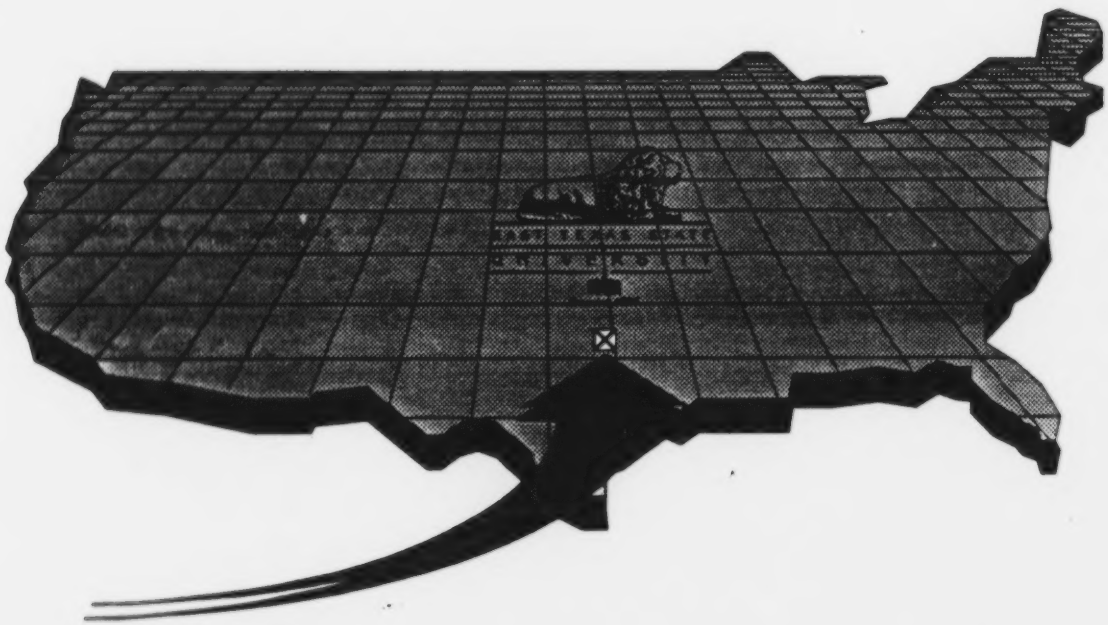
III. Goal(s)	Priority* *How important is the goal?*	
Goal supported by data element-- i.e. better recruitment of students		*State the goal of the department/college/school that is supported by these data.*
How data element supports goal		*Explain how these data help support the above stated goal.*

* Note: Ranking/Priority range is from (1) highest to (5) lowest.

Source: TWU, Office of Institutional Research and Statistics.

East Texas State University

Student Follow-up Study



East Texas State University
Commerce, Texas

Presented by: Dr. Ron Huffstutler
Dean of Institutional Effectiveness and Continuing Education
and
Dennis Brandt
Data Analyst
Department of Institutional Research

Introduction

Offices of institutional research are often asked to track students who enter their institution. Many questions are asked. Do they graduate? Do they transfer to another college or university? How long did they stay or how long did they take to graduate? Did they successfully achieve their educational objectives? These are but a few of the questions that lend themselves to some type of analysis through a student tracking or follow-up system. These and other such questions are asked by administrators, legislators and accrediting bodies who are interested in the success of students as well as institutional effectiveness and program quality.

The automated follow-up system being developed in Texas under the leadership of the State Occupational Information Coordinating Committee (SOICC) can be a powerful tool, for not only tracking students, but also for identifying successful labor market outcomes for education. By record matching in the Texas Higher Education Coordinating Board's databases and the Texas Employment Commission's unemployment insurance wage records, the follow-up system can identify where students who leave an institution go. It identifies those who continue their education at other public institutions of higher learning. Those who have left to go to work have their employment and wage earnings noted. An analysis of this information could provide valuable information for university planning and program improvement.

At its inception, the SOICC study dealt exclusively with students at public community colleges. However, in the fall of 1992, East Texas State University (ETSU) was chosen to pilot the study for all Texas public universities. Currently, the SOICC study is being expanded and perfected as a cost-effective automated follow-up system that may be used by all agencies concerned with improving their educational and training programs and job placements. Public schools, JTPA's and others are joining in the development of the system.

Background

For the purpose of this paper, institutional student enrollment data for the periods, Summer I 1991, Summer II 1991, Fall 1991 and Spring 1992 were utilized. The automated student follow-up system utilizes the Texas Higher Education Coordinating Board's (CB) database to create an initial file of all students who had attended ETSU in any of the semesters, Summer I 1991 through Spring 1992, but were not enrolled at ETSU in Fall 1992. During this period, there were a total of 6,066 students identified who satisfied these conditions. Of these, 1,336 students had graduated and 4,730 students had left the institution for other reasons. For this study non-returners and leavers are used changeability.

Of the 4,730 leavers, the follow-up database locates 2,565 or 94 percent of the graduate level students and 1,785 or 89 percent of the undergraduates as either in another institution or in the

workplace or both. Thus, 4,350 or 91 percent of all the leavers were located. Private institutions, military, and out-of-state employment are not included in the search conducted through the TEC and CB databases.

Table 1
File History and Development

Coordinating Board		TEC	Employer Follow-up
Sum I 91, Sum II 91, Fall 91, Spring 92	Fall 92	4th Quarter	Future Date
Social Security	Social Security	Social Security	Social Security
Ethnicity	FICE matching institution	Employer SIC code	Job Title
Gender	Major	Company Name	Job classification
Classification	SCH	DBA name	Wages
Date of Birth	Semester, year of enrollment	Address	Full/Part time
SCH's Sum I 91		Wages	Job-Zip code
SCH's Sum II 91		Reporting period	
SCH's Fall 91			
SCH's Spring 91			
Type Degree			
Last Semester Enrolled			

The CB file contained the data element list in columns one and two of Table 1. Next, the CB student database file was matched by social security number to the Texas Employment Commission's (TEC) unemployment insurance wage records. From that match, the information added for those found to be employed is given in column three of Table 1. Column four of Table 1 has not been received by ETSU to date. The information listed will be provided by a survey of employers which will be completed by May 1994.

The final version of the data file contained 6,066 individual student records contained in 9,853 records. The increased number of records occurred when student records were duplicated for each employment record that was reported. The 6,066 student data elements were expanded to include the following information obtained from the ETSU mainframe database.

- Number of hours passed in dropout semester
- GPA of dropout semester
- Cumulative hours attempted
- Cumulative hours passed
- Overall GPA
- Home address including zip code
- TASP, SAT, ACT
- Financial Aid

The ETSU data file records were matched with the SOICC records with a 99 percent accuracy. Unfortunately, the local data fields (TASP, ACT, SAT) were not complete for all students. Therefore, an analyses involving these items is not included at this time. The financial aid file is in the process of being extracted and may provide some evidence of students leaving for various financial reasons.

Data Analysis

Graduates and Leavers

It is important to identify the different type of students being considered. The 6,066 ETSU student records can be subdivided into a number of subcategories. First, Table 2 classifies students as graduates or non-returners—leavers. Table 3 further classifies graduates as working, pursuing additional education or both. Leavers can be found to be working, to have transferred to another institution or both. Tables 4 shows the type of institution the 888 transferring students transferred to. All three tables are located on the following page.

Table 2 Classification of Graduates and Non-Returners	
➢ **Graduates**	
Undergraduate	780
Graduate	556
Total Graduates:	1,336
➢ **Non-returners (leavers)**	
Undergraduates	2,006
Graduate	2,724
Total Non-returners	4,730
Total Graduates and Non-returners	6,066

Table 3 Status of Graduates and Non-returners	
Pursuing additional education only	121
Employed	4,647
Both: Working students	767
Total:	5,538[1]
[1] 5,538 of 6,066 students identified equals 91%	

Table 4 Type of Institutions Students Transferred To	
Senior Institution	551
Community College	334
Public Health Center	3
Total Graduate and Undergraduate Transfers	888

Retention of Incoming Transfer College Students

One important field of data identified students as incoming transfer or first time in college students. The SOICC data were combined with transferring student data from the Admissions Office to determine retention and to identify reasons for students leaving or transferring to other institutions during the period under study. The incoming transfer students were classified as having transferred from a community college or university. They are presented in Table 5 (Transfer in Students) on page 6. Those transfer students that left are represented by 7 graduates and 463 leavers. Of the 463 leavers, 156 transferred to another institution and, therefore, were retained in higher education. The total number of students retained in higher education is comprised of two groups, those who transferred to another institution (156) and those who remained at ETSU (1,048). That figure represents a retention rate of 79 percent retained in higher education (1,204/1,518).

The transfer leavers were identified by classification and the type of institution to which they transferred. Of the 156 students that remained in college 85 or 55 percent transferred to a community college and 71 or 45 percent transferred to a university. The chart in Figure 1 represents the total number (463) leaving by classification. The number of leavers was fairly evenly divided between the freshmen, sophomore and junior classes.

Figure 1

Classification of Leavers

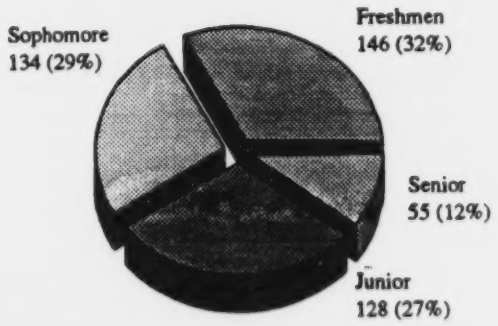


Table 5
Transfer Students and Retention

Institution	Transfer in Students	Percent
Community Colleges	1,123	74.0%
Senior Universities	395	26.0%
Total:	1,518	100.0%
Students that left ETSU		
Graduates	7	1.0%
Leavers	463	30.0%
Retained (still enrolled at ETSU)	1,048	69.0%
Transferred to another Institution	156	10.0%
Total retained in Higher Education	1,204	79.0%

Other Undergraduate Non-Returners—Leavers

Students leave a institution and transfer to another institution for a variety of reasons. Some of the more important reasons would include:

- pursuit of major not available at present school,
- transfer to another school because of job transfer,
- transfer to another school because family moved, and
- transferred to community college, change to technical career.

A study of 2,006 undergraduate leavers identified in Table 2 are presented in Table 6. Most of the leavers had declared a major, but a significant number, 22.4 percent, had not declared a major before leaving ETSU. Table 6, page 7, presents the leavers by the major they had declared at ETSU. The largest single group was the undeclared major group with 22.4 percent of the total. Together, the undeclared major and liberal arts-undeclared major represented 31.6 percent of the total undergraduate leavers.

Table 6
Classification of Leavers by Major

Major	Leavers	Percent
Business	361	18.0%
Education	221	11.0%
Pre-Law and Health	73	3.7%
Liberal Arts-Undeclared	185	9.2%
Undeclared Major	450	22.4%
Other Majors: General	716	35.7%
Totals:	2,006	100.0%

Table 7, page 8, identifies whether or not the transferring students changed their major after they transferred to another institution. Of the students declaring a business major, 43 or 51 percent changed their major when they transferred. A significant number changed to a major not available at ETSU—notably nursing. In education, 8 or 17 percent of the education majors changed their major to nursing, while the majority, over 58 percent, left the educational field in pursuit of studies in other areas.

Twenty-one of the 36 students who declared pre-law or health fields—neither major degree available at ETSU—transferred by the fall of 1992, of those declaring health fields, 9 percent stayed in the same field, while all but one pre-law major changed fields. Of all the students who transferred with a liberal arts-undeclared or undeclared major, 83 percent of the liberal arts-undeclared majors and 88 percent of the undeclared majors declared a specific major at the transfer institution.

Although there is no conclusive evidence, two groups of students leaving ETSU are of special interest. One group apparently came to ETSU to obtain the basic university studies part of their education. Perhaps this can be attributed to by the fact that they were closer to home, it was less costly, or any number of other reasons. They never intended to remain at ETSU. The number of students who did not declared a major at ETSU but did as soon as they enter the transferred institution suggests the validity of this assumption. Another group, apparently transferred because their chosen major program was not available at ETSU.

Table 7
Classification of Transferring Leavers by Major

Major	Number of Students Transferring to Another Institution	Number of Students Changing Their Major	Percent Changing Their Major
Business	85	43	51.0%
Education	87	47	54.0%
Pre-Law and Health	36	21	58.0%
Liberal Arts-Undeclared	90	75	83.0%
Undeclared Major	133	117	88.0%
Other Majors: General	249	122	49.0%
Totals:	680		

Transfers to Two Local Community Colleges

An additional follow-up was completed on 58 transfer students involving two local community colleges. A data file was sent to the Institutional Researcher at each institution who than ran the ETSU data file against that colleges student records. The resulting information confirmed that a significant number continued their educational programs and over 25 percent have received an Associate Degree or a Certificate of Completion. Table 8 indicates that a significant number, 29.3 percent, entered nursing programs which are not available at ETSU.

The transcripts of these students indicated that a significant number of them attempted to fulfill their college mathematics requirements at the community college. If students were experiencing trouble completing courses at the university, mathematics was usually the area that had the greatest impact, a significant number of them returned to the community college to complete these requirements.

Table 8 Follow-up of Local Community College Transfers		
Associate Degree or Certificate of Completion	15	25.9%
Still enrolled Spring 93	20	34.5%
Nursing Program (enrolled and completers)	17	29.3%
Part-Timers	15	25.9%

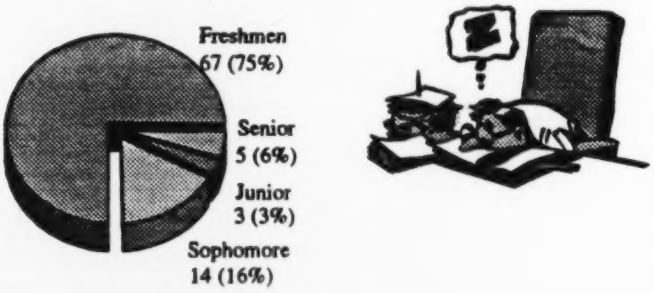
Leavers Due to Academic Performance

As would be expected, a number of students left because they were not able to complete college level work. In order to complete this study, all undergraduate leavers were compared to the mainframe database to determine the number no longer eligible for admission (GPA less than 2.00). The number identified with GPA's less than 2.00 was 89 or 4.5 percent of the total number of leavers. One group of leavers was identified as having transferred from a community college to ETSU and, after one or more unsuccessful semesters at ETSU, transferred back to the same community college. The complete GPA study is presented in Table 9 and Figure 2. A significant number of students left without completing the semester and receiving a grade. Figure 2 identifies the leavers by classification. As expected, the leaves are concentrated in the freshmen and sophomore classes. If a student completes the basic studies the odds of completing are significantly increased.

Table 9 Undergraduate Leavers Due to Low GPAs				
Class	No.	Avg Hours Attempted	Avg Hours Completed	Avg GPA
Freshmen	67	9.48	5.99	1.37
Sophomore	14	9.21	7.43	1.66
Junior	3	9.00	7.00	1.56
Senior	5	6.40	5.20	1.23
Totals:	89	9.25	6.20	1.42

Figure 2

Leavers by Class Due to GPA



Impact of Permanent Address

A further analysis of the 680, Table 7, undergraduate transfer students was conducted by adding the permanent city and zip code address to the SOICC database and comparing that to the transfer school's local address and zip code. The reasons for the change of institutions can not clearly be established, but over 28 percent of the students transferring to a community college found one closer to their permanent address than the ETSU campus. Of the transfer students, 7.5 percent had scholastic problems with a GPA of less than 2.00, and many more had dropped out without completing the semester and receiving a grade.

Table 10

Transfers to Other Institutions

Community College

- ☐ 92 or 28.8 percent transferred to schools that were considerably closer to home mailing address and zip code
- ☐ 24 or 7.5 percent had GPA's of less than 2.00 overall

Senior University

- ☐ 59 or 16.5 percent transferred to schools closer to home

The same trend of attending a university closer to the reported permanent home address was also observed in the group that transferred to a senior university. However, this fact was not nearly as pronounced. These data are presented in Table 10 on the previous page.

Non-Returning Graduate Level Students

The greatest number of leavers were in the Graduate School. There were 2,724 students who entered and left the ETSU graduate programs between Summer I, 1991 and Fall 1992. The Venn diagram in Figure 3, page 12, shows that many graduates attend one semester but do not return the next semester for one reason or another. A number of reasons have been identified for the large turnover in the Graduate School.

1. Many of the non-degree graduate students are students who have completed a bachelor's degree and are now returning to complete a teaching certificate. These students, in the past, have not been tracked by the system, but represent a significant number of individuals. Since they are not identified by the system as having completed a program, they disappear from the University and are identified only as a leaver not as a completer. A manual count of completers by the Teacher Certification Office identifies 659 students as having completed their certification program from the Summer 91 semester through the Summer 1992 semester. This group accounts for 659 of the 1,547 (42.6 percent) identified in Table 11 as graduates in the non-declared major group.

2. Most graduate students (83 percent) are part-time students attending classes in the evening while working full time. They come and go depending on class availability, work schedules, changes in family life, and other time requirements. This fact is evident by observing that only 92 students attended in the summer and spring and only 232 or 8.5 percent attended all three semesters.

3. The summer graduate program at ETSU attracts may education majors working towards certification or a master's degree. Most of the summer students are full time school teachers or administrators and attend only during summer when the public schools are closed for summer breaks. In fact, 1,894 or 69.5 percent of the graduate students attended for only one semester, and of those 1,005 or 36.9 percent were summer only attendees. (See Figure 3)

Figure 3

Graduate School Leavers

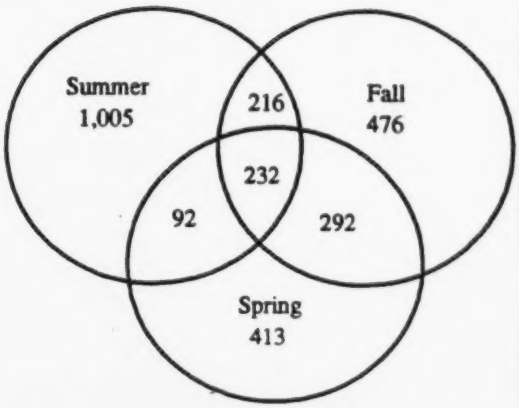


Table 11
Graduate School Leavers by College

College	No.	Percent
Education	863	31.7%
Bus & Tech	67	2.5%
Arts & Sciences	247	9.0%
Non-Declared Major	1,547	56.8%
Total:	2,724	

Work Force Study

Salaries of Undergraduate and Graduate Leavers

Just because a student is classified as a leaver does not mean he or she is a dropout. Table 12 clearly shows that 53 percent of the undergraduate leavers earn over $10,000 and the average wage is $23,000. Since the SOICC database did not identify full time employment, and in many cases includes several part time jobs for individuals, certain assumptions were made regarding the averages. For the most part only those individuals whose salaries were at or above a predetermined level were used to calculate salary averages.

Many of the graduate students were not just preparing for work, but maintained jobs and perhaps earned advancements though the ranks. Of the 2,724 graduate leavers, 1,986 were found as having jobs. Fourteen percent (346) of the 1,986 graduate leavers earned salaries greater than $40,000 with an average salary of $49,916. The majority of the cohort, 1,640 or 68 percent, fell within a salary range of $20,000 to $40,000 with an average salary of $28,478. These are professional people continuing to gain additional education.

Table 12 Leavers—Average Salaries			
Number	Percent	Salary	Avg Salary
➢ **Undergraduate Leavers**			
387	31.0%	$5,000-10,000	$7,200
662	53.0%	>$10,000	$23,000
1,049	88.0%		
➢ **Graduate Leavers**			
1,640	68.0%	$20,000-40,000	$28,478
346	14.0%	> $40,000	$49,916
1,986	82.0%		

Students Receiving Degrees

To date, the analysis has concentrated on leavers. But what about those students that completed their education and appear to be working full time? Table 13 and Figure 4, page 14, show the average salaries reported for ETSU graduates by the degree awarded. An annual salary base of $12,000 was used for the purpose of this analysis. Using a lower salary base allowed more of the new graduates with entry level positions to be included. This table includes over 75 percent of the graduates for the reported period. Some graduates are not included because they have enrolled in the Graduate School and are still full time students with part time jobs.

If the base salary is increased to $20,000, some entry level graduates are not included in the study, but the average salaries increase significantly. Even at this higher base rate over 50 percent of the graduates are included in Table 14 and Figure 5, page 15.

Table 13
Average Salaries Reported for ETSU Graduates by Degree Awarded

Degree	Responses	Average Salary
Ed.D.	30	$46,880
MBA	26	$38,888
MS	175	$30,088
MED	183	$28,352
BS	199	$23,744
BBA	93	$22,518
BA	140	$19,498

Figure 4
Average Salaries Reported for ETSU Graduates by Degree Awarded
$12,000 Base Salary

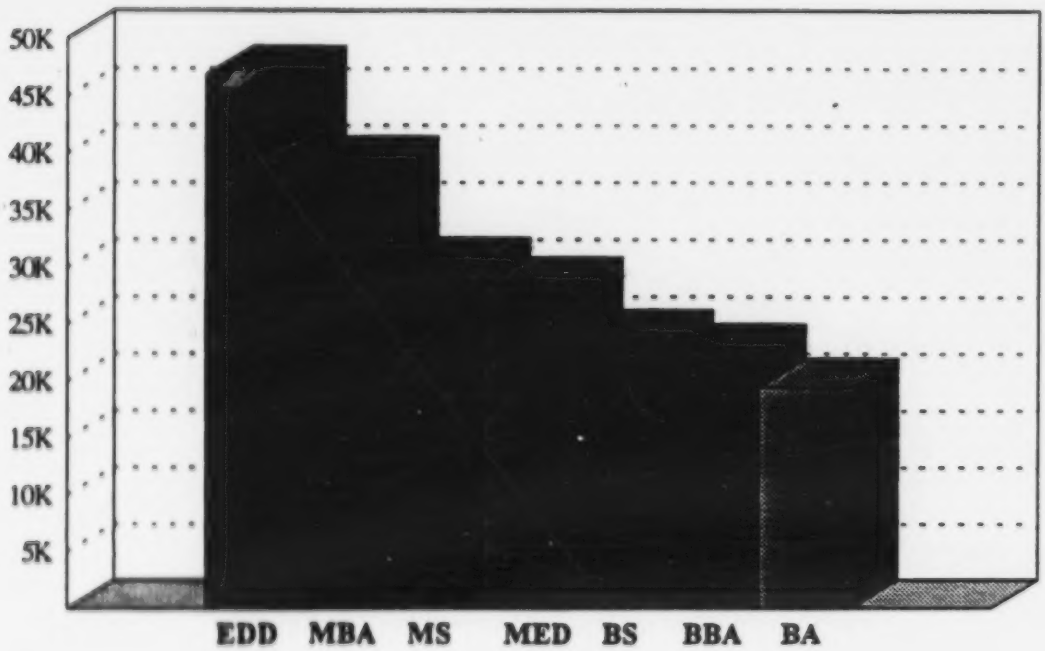
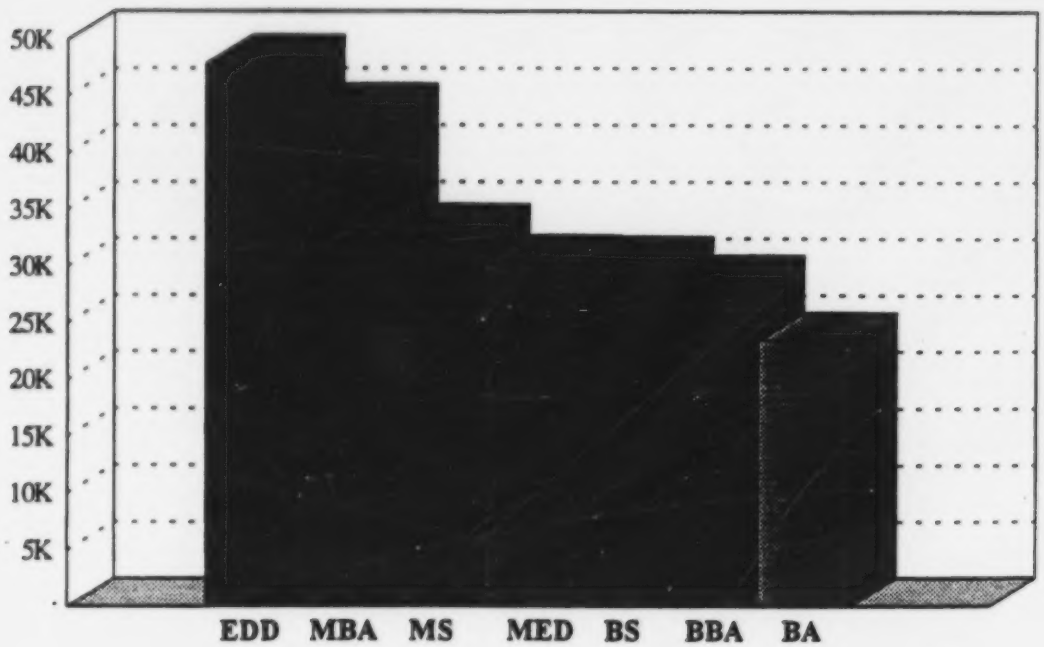


Table 14
Average Salaries Reported for ETSU Graduates by Degree Awarded

Degree	Responses	Average Salary
Ed.D.	29	$47,880
MBA	22	$43,580
MS	145	$32,950
MED	159	$30,196
BS	108	$30,116
BBA	49	$28,488
BA	43	$23,438

Figure 5
Average Salaries Reported for ETSU Graduates by Degree Awarded
$20,000 Base Salary



It should be noted that it is not known if the jobs held by members of this cohort are related to their degree program or not. That information will be available through the employer follow-up study.

Conclusion

The student follow-up analysis presented in this paper has been shared with the president, vice presidents, deans, and department heads. It has helped them have a better understanding of the makeup of the ETSU student body and the reasons why students come to and leave ETSU.

Much more remains to be done to fully utilize the information obtained from the SOICC statewide follow-up system and local information. At present, plans are being made to utilize the Lone Star Student Tracking system to examine how patterns of course taking impact non-returners. For instance, the analysis has already verified anticipated assumptions regarding students leaving ETSU because they have encountered difficulty with mathematics or beginning accounting courses. This additional analysis may provide support for what has been anticipated.

In addition, the results may have implications for mission and program direction. The University's mission statement does not identify the certification of teachers at the graduate level as an important undertaking. Data from the follow-up reveals the 40 percent of the graduate students in the study are involved in this very activity. Perhaps, then, further analysis will assist the University in and clarifying its mission, role, and scope.

Examining Gender Equity in Athletics

Richard W. Middaugh

Abstract

Although the 20th anniversary of Title IX legislation requiring gender equity has passed, many institutions of higher education and their intercollegiate athletics programs have not addressed the issue. Recently, the frequency of complaints filed with the U. S. Office of Civil Rights, several well-publicized legal cases, and NCAA legislation have focused attention on gender equity in athletics. This paper provides an overview of research techniques employed in a gender equity study, the results of research conducted at a comprehensive state university, and the use of research findings as the basis for a plan to achieve gender equity in an intercollegiate athletics program.

Background

In 1972, the U. S. Congress passed Title IX of the Education Amendments to the 1964 Civil Rights Act and prohibited discrimination based on gender in programs and activities that receive federal financial assistance. There was a general expectation that discrimination remaining in educational institutions would be targeted and remedied. Over two decades later, gender equity in intercollegiate athletics programs remains a controversial issue fueled by many lawsuits, settlements, and U. S. Office of Civil Rights reviews.

Gender equity was embroiled in controversy from the very beginning. Stromquist's (1989) analysis of how inputs (the law) and intervening variables (women's movement, demographic shifts, economic conditions) have combined to produce observable transformations in educational institutions offers a concise history of the gender equity in education movement. A review of legislative actions found that athletics was not mentioned in Title IX nor was it discussed in the Congressional debates that preceded passage (Murdaugh and Rebell 1992).

In late 1973, some hope for the development of Title IX policies by athletic associations was raised when the now defunct Association for Intercollegiate Athletics for Women (AIAW) voted at its first assembly to meet with representatives of the National Collegiate Athletics Association (NCAA), the National Association for Intercollegiate Athletics, and the National Junior College Athletic Association. Although the NCAA initially agreed to meet, the meeting and joint policy development never materialized. Instead, the NCAA announced the formation of it's Women's

Paper presented at the Texas Association for Institutional Research, 16th Annual Conference, El Paso, Texas, February 23-25, 1994

Committee when the NCAA learned that revenue sports would be under the jurisdiction of Title IX (Carpenter 1993). Three years after passage of Title IX, the inclusion of athletics in the original regulations, issued by the then Department of Health, Education and Welfare, raised immediate outcries, delaying formal policy interpretations until 1979 (Department of Health, Education and Welfare 1979).

Actual application of the provisions of Title IX to athletics was interrupted by the 1984 Supreme Court decision of *Grove City College vs. Bell* (Vargyas 1989), which limited the application of Title IX to programs and activities that directly received federal funds. *Grove City* caused the U.S. Department of Education to curtail or dismiss immediately forty investigations (Villalobos, 1990). In addition, other complaints against athletic departments were not pursued by OCR because claimants could not show that departments received direct federal funding.

The Civil Rights Restoration Act, passed by the U.S. Congress in 1987 over presidential veto, amended Title IX to include all operations of agencies which receive federal financial assistance and immediately reversed the impact of the *Grove City* decision, resulting in the filing of sixteen complaints against universities in the succeeding six months (Oberlander 1988). A subsequent 1992 decision, *Franklin vs. Gwinnett*, affirmed the right to sue and receive damage awards (American Alliance for Health, Physical Education, Recreation and Dance 1992).

After examining legal decisions, Murdaugh and Rebell found wide spread acceptance of both separate-but-equal sports programs and co-educational teams as a means to achieve equity. They offer the following observation regarding Title IX:

> Although Title IX and the federal court decisions have established equal access to sports as a national value and have substantially broadened female participation in school sports, they have left a broad scope for local discretion on the gender role dimensions of the issue (Murdaugh and Rebell 1992, p.193).

In spite of considerable controversy, and a call issued by Tittle (1985) for members of the American Education Research Association to conduct equity research, clues in the literature are hard to find. Irwin's (1992) mini-meta analysis of over 200 published reports of equity research found that empirical studies were rare. A literature search found no publication of athletics equity studies undertaken at the nation's colleges and universities. Numerous reviews performed by the Office of Civil Rights (OCR) are occasionally reported in news media, but lack formal publication.

While OCR has responsibility for Title IX enforcement, significant strides have not been made in athletics. Bornstein (1980) found that Title IX technical assistance personnel rated athletics and physical education as most significantly unchanged due to Title IX. Stromquist (1989) concluded that Title IX has not been effectively enforced, largely because of lack of funds. A report prepared by the American Association of University Women (1992) describes enforcement by OCR as complaint driven and lacking active pursuit. The Lyndon B. Johnson School of Public Affairs found that "OCR's underlying lack of commitment to ensuring civil rights and to making gender equity a reality is clearly evident in the area of intercollegiate athletics" (Lyndon B. Johnson School of Public Affairs 1993, p. 1).

In 1991, NCAA, spurred by a resolution adopted by the Council of Collegiate Women Athletic Administrators, began to investigate equity by announcing a study of institutional athletic expenditures for men's and women's sports programs (Schultz,

letter June 14, 1991). Concurrently, the NCAA began to review legislation, policies and procedures to determine if the impact on athletes was equitable.

The NCAA offered few conclusions in its discussion of the results of the Gender Equity Study (NCAA 1992). A review of the findings, including a three-to-one funding ratio in favor of men, shows that compliance is not evident.

After reviewing existing NCAA legislation and the results of the Gender Equity Study (NCAA 1992), the NCAA Gender Equity Task Force issued a Preliminary Report (1993) proposing the following principles:

1. It is the responsibility of the Association's members to comply with Federal and state laws regarding gender equity.

2. No legislation shall be adopted by the Association that would prevent member institutions from complying with applicable gender-equity laws.

3. The Association should adopt legislation to enhance member institutions compliance with applicable gender-equity laws.

4. The activities of the Association should be conducted in a manner free of gender bias. (Preliminary Report, NCAA Gender Equity Task Force, 1993, p. 1).

The Final Report from the NCAA Gender Equity Task Force (1993) restated these principles, called for association legislation on emerging women's sports and athletic scholarships, and made recommendations on hiring opportunities, national championships, funding of conference gender-equity committees, additions to coaching staff, and out of season coaching for female athletes. After consideration, the NCAA Council decided not to seek adoption of the legislation, instead opting to put only the equity principles to a vote in January 1994 (Associated Press, August 7, 1993). These statements were adopted at the 1994 convention (NCAA News, January 26, 1994).

After legal decisions, NCAA actions, and a search of the literature, evidently the achievement of gender equity in athletics is a local responsibility often ignored by institutions until an OCR complaint or lawsuit is filed. The American Association of University Women (1992) calls for vigorous enforcement as a top priority and the increasing frequency of lawsuits may cause universities to formally address gender equity.

The U.S. Congress has responded to criticism of Title IX enforcement by introducing legislation (NCAA News, January 19, 1994). H.R. 921 and S. 1468 would require the disclosure of athletics participation rates, personnel, recruitment, scholarships, and expenditures. Several other bills promoting gender equity are under consideration (S. 1513, H.R. 1793, H.R. 921). Two bills, H.R. 1743 and S. 1464 would establish an Office of Gender Equity within the U.S. Department of Education. As of this writing, this proposed legislation has received little attention and appears likely to die.

With sparse publication of research findings, broad principles adopted by athletic associations, and confusing legal decisions, how does an institution assess its own compliance regarding athletic programs, achieve equity, prepare for information disclosure and protect itself from investigations and costly litigation?

The Title IX Athletics Investigator's Manual (Bonnette 1990) guides investigations of complaints by the OCR. This study attempts to adopt and augment the methods provided in this manual in an effort to initiate development of a research and evaluation model.

Purpose

The purpose of this paper is to describe one gender equity study of intercollegiate athletics conducted at a regional state university. The goal of this study was to identify existing inequities and provide a foundation for the development of a university plan to produce equity in the athletics program. An overview of the methodology is presented and specific findings discussed. The importance and use of the findings by the university to cause gender equity through planned actions is also presented.

The topics investigated included athletic financial assistance, team travel, facilities, tutorial services, and the accommodation of student interests and abilities.

Method

Given the scope of Title IX, the application of a singular research method was deemed impossible. Since the methods of inquiry differ by topic, the research methods employed and results are presented by topic.

Prior to gathering and analyzing data, interviews were conducted with each head coach and the Athletic Director. At the beginning of the interviews, a brief introduction to the study was given and the coaches were assured that any answers and comments made during the session would be offered in summary form only. Coaches were also informed that specific assessments or opinions offered were important in that these comments might spur additional inquiry. The introduction was followed by a series of structured questions identical in focus for all sports. Answers were open ended and recorded in notes taken by the investigator.

Data and information were obtained from several sources. Athletic scholarship data were gathered from official team rosters submitted to the athletic conference. Information concerning athletic facilities was gained from interviews and facility tours. Information concerning tutorial services was also obtained and verified through interviews with head coaches and the Athletic Director. Travel expenditures were obtained from the university accounting system and actual travel authorization and reimbursement forms.

Equity In Financial Assistance To Athletes

Under Title IX regulations, institutions must provide scholarship awards to athletes for each gender in proportion to the number of students of each gender participating in intercollegiate athletics programs.

The approach used to determine equity in financial assistance by the Office of Civil Rights is source-blind. The source of funds which support athletes is not relevant, only the treatment and opportunities given to athletes is considered.

Athletic scholarships provide funds for tuition, room, board and books up to a maximum of $4,914 for in-state athletes and $8,242 for out-of-state athletes. Table 1 shows total athletic aid according to official team rosters provided by the Athletic Department. Aid amounts represent planned expenditures for the 1992-93 academic year. A total aid expenditure of $587,454 was budgeted, with women athletes allocated $162,524 and men $424,930.

Table 1
Total Athletic Aid by Team

Gender	Team	Number On Roster	Number On Aid	Total Aid
Women	Basketball	11	11	$46,312
	Softball	21	16	$35,410
	Tennis	7	7	$18,454
	Track*	20	17	$27,598
	Volleyball	12	12	$34,750
	Total Women	71	63	$162,524
Men	Baseball	35	21	$45,344
	Basketball	15	14	$66,918
	Football	118	81	$276,126
	Golf	18	7	$15,928
	Track*	18	12	$20,614
	Total Men	204	135	$424,930
Total		275	198	$587,454

*Represents unduplicated count of indoor, outdoor & crosscountry

Table 2 shows the number and percent of athletes awarded aid. Overall, 88.7% of women received athletic aid as compared with 66.2% of men. Of all athletes, 72% received athletic financial assistance.

Table 2
Number & Percent of Athletes Receiving Aid by Team

Gender	Team	Number On Roster	Number On Aid	Percent On Aid
Women	Basketball	11	11	100.0%
	Softball	21	16	76.2%
	Tennis	7	7	100.0%
	Track*	20	17	85.0%
	Volleyball	12	12	100.0%
	Total Women	71	63	88.7%
Men	Baseball	35	21	60.0%
	Basketball	15	14	93.3%
	Football	118	81	68.6%
	Golf	18	7	38.9%
	Track*	18	12	66.7%
	Total Men	204	135	66.2%
Total		275	198	72.0%

*Represents unduplicated count of indoor, outdoor & crosscountry

For athletic aid to be equitable, the proportion of aid awarded to each gender should equal the proportion of each gender participating. Table 3 provides this comparison.

Table 3
Amount of Athletic Aid Awarded

	Men	Men	Women	Women	Total Participants	
	Number	Percent	Number	Percent	Number	Percent
Athletes	204	74.18%	71	25.82%	275	100.00%
Athletic Aid	$424,930	72.33%	$162,524	27.67%	$587,454	100.00%

Of all athletes, 74.18% were men; 25.82% were women. Men received $424,930, or 72.33% of financial assistance; women received $162,524, or 27.67%. Since the proportion of participants does not equal the proportion of aid awarded, further analyses were conducted to determine if the proportions are substantially equal.

A *z-test* (Bonnette 1990) was used to determine whether the difference in the percentage of total aid awarded to women and the percentage of female participants was significant. This analysis produced a *z-value* of -0.68445, indicating no significant difference. Using the 95% confidence interval, the *z-value* would exceed 1.96 if the difference was significant. Athletic aid to women was awarded in accord with the proportion of athletes who are female.

The average amount of aid awarded to athletes is also an indication of equity. Table 4 presents the mean and range of awards for each team. Women on aid received a mean award of $2,580, while the mean award to men was $3,148. The mean award to all athletes was $2,967.

Table 4
Range and Mean of Athletic Aid Awards by Team

Gender	Team	Number On Aid	Mean Award^	Range of Awards Minimum	Maximum
Women	Basketball	11	$4,210	$372	$4,820
	Softball	16	$2,213	$1,476	$3,850
	Tennis	7	$2,636	$1,864	$3,216
	Track*	17	$1,623	$600	$3,228
	Volleyball	12	$2,896	$1,500	$3,800
	Total Women	63	$2,580	$372	$4,820
Men	Baseball	21	$2,159	$1,192	$3,996
	Basketball	14	$4,780	$4,232	$8,312
	Football	81	$3,409	$318	$7,786
	Golf	7	$2,275	$400	$3,092
	Track*	12	$1,718	$740	$3,074
	Total Men	135	$3,148	$318	$8,312
Total		198	$2,967	$318	$8,312

^Rounded to nearest dollar
*Represents unduplicated count of indoor, outdoor & crosscountry

An independent-samples *t-test* (SPSS 1993) was used to determine if the difference in the mean award to each gender was statistically significant. First, Levene's test for the equality of variances was performed to test the assumption of equal variances. Results (F= 1.825, p=0.178) indicated that this assumption was valid.

Results of the *t-test* are presented in Table 5. The *t-test* produced a *t-value* of 2.71, which is statistically significant. The mean award to men exceeds that for women by $567.88. This finding indicates that men and women do not receive substantially equal financial assistance.

Table 5
t-test on Athletic Awards to Men and Women Athletes

Sex	Number	Mean	Standard Deviation	Standard Error Of Mean
Men	135	3147.630	1433.002	123.333
Women	63	2579.746	1226.407	154.513

Mean Difference= 567.884

Levene's Test for Equality of Variances: F= 1.825 P= 0.178

t-test for Equality of Means

Variances	t-value	Degrees of Freedom	2-Tail Significance	Standard Error of Difference	95% Confidence Interval for Difference
Equal	2.71	196.00	0.007	209.189	(155.241,980.526)

Discussions with the Athletic Director and the Assistant Athletic Director failed to yield any non-discriminatory reasons for this difference. Therefore, The University is not in compliance with Title IX when the element of financial assistance to athletes is evaluated.

Compliance can be achieved by providing increased financial assistance to women athletics. Given the mean difference of $568 per athlete, it would cost $35,784 to support women at the level of men. Even with funding, it will be difficult to achieve equity within the present mix of sports and squad sizes.

Team Travel

Under OCR policy interpretation (Bonnette 1990), team travel is evaluated using five factors:

1. Per diem allowances
2. Mode of transportation

3. Housing during travel
4. Length of stay before and after events
5. Dining arrangements

Several practices used by coaches, while fiscally sound, make comparative analysis of travel difficult. A review of travel documents and interview data indicate that no per diem allowances are made; instead expenditures are determined by the head coaches with the goal of remaining within the total team budget. Food is often purchased from grocery stores in lieu of restaurant dining. Coaches solicit bids for hotels and transportation, selecting the best bid. Occasionally, teams travel separately in groups, leaving and returning on different days and times.

Given these practices and inherent limitations, assessment of team travel under each of the OCR factors was not possible. The analysis which follows focuses on two aspects: modes of transportation and travel expenditures in proportion to participation rates of each gender.

Modes of Transportation

Modes of transportation used by athletic teams to away events include university vehicles, rental cars and vans, rental buses or coaches, and air. Travel squad size, distance and cost obviously influence this choice.

A review of transportation mode used by teams when traveling similar distances shows that vans or university vehicles are used more often by women's teams. On some trips, this may be a consequence of the size of the travel squad. However, there are instances when teams traveled with comparable squad sizes to the same location and used different types of transportation. For example, both the men's and women's basketball teams traveled to Natchitoches, Louisiana with travel squads of twelve and ten athletes, respectively. The men's team chartered a bus, while the women's team rode in vans. A trip to Denton, Texas was similar. Interview data suggest that men's team travel is sometimes funded by game guarantees and therefore, the cost of coach rental can be afforded.

Given the numerous destinations and only one year of travel data, it is hard to conclude that the instances cited are the result of discrimination. However, a pattern of occurrences of this nature would demonstrate bias regardless of source of funds. Consideration should be given to planning team transportation at the department, rather than team level.

Travel Expenditures

Travel expenditures by team during the 1992-93 fiscal year are presented in Table 6. (Travel expenditures for the track team are not included because this team is co-educational). The costs include student transportation, lodging and meals. Costs for coaches and auxiliary personnel travel are not included.

Table 6
Total Athlete Travel Expenditures By Team

Gender	Team	Number On Roster	Total Athletic Travel
Women	Basketball	11	$7,224
	Softball	21	$15,379
	Tennis	7	$3,577
	Volleyball	12	$14,630
	Total Women	51	$40,810
Men	Baseball	35	$26,222
	Basketball	15	$19,646
	Football	118	$26,210
	Golf	18	$5,932
	Total Men	186	$78,010
Total		237	$118,820

A total of 237 athletes were listed on team rosters; 21.5% were female. Travel expenditures for female athletes totalled $40,810, or 34.4% of the total travel costs.

One method for measuring equity of travel expenditures is to compare the proportion of travel funds expended to the proportion of that gender participating in athletics. A *z-test* (Bonnette 1990) was used to determine whether the difference in percentage of women's travel expenditures and the percentage of women participating was significant. The *z value* which resulted was -4.1468. Using p=0.05, this value exceeds the critical value of 1.96, indicating a significant difference. However, this difference is in favor of female athletes.

While a significant difference was found, it should be noted that this investigation was limited to one year and that considerable deviation may occur from season to season. The number of away games varies each season as does the opportunity to participate in post-season competition.

Tutorial Assistance

The Title IX Investigators Manual (Bonnette 1990) lists three factors associated with the provision of tutorial services that are used in the assessment of compliance:

1. Availability of tutoring
2. Procedures and criteria for obtaining assistance
3. Qualifications of tutors

Information gathered during interviews with coaches and athletic administrators indicates that athletes are provided tutors during scheduled study halls which are open to athletes from any team. Athletes are not provided individual tutors at the expense of the Athletic Department. Athletes needing private tutoring are assisted in finding a tutor through the appropriate academic department but payment remains the responsibility of the athletes.

Given these practices, no difference in the tutorial services offered to men and women athletes is evident.

10

The Provision And Availability Of Athletic Facilities

According to the Title IX Investigator's Manual (Bonnette 1990), an OCR policy interpretation of Title IX calls for use of six factors in the assessment of compliance regarding the equitable provision of athletic facilities:

1. Quality and availability of practice and competitive event facilities;
2. Exclusivity of use of these facilities;
3. Availability of locker rooms;
4. Quality of locker rooms;
5. Maintenance of practice and competitive facilities;
6. Preparation of facilities for practice and competitive events.

In an effort to gather information for assessment of the athletic facilities, all facilities were visited and each head coach was interviewed by the investigator. During each tour, notes about the condition of the facilities were made by the investigator. In addition, the Assistant Athletic Director was interviewed about each facility. In addition to the tour and interviews, with the exception of track/cross country, the investigator observed at least one practice session or competitive event for each team.

The results which follow are clustered by the factors used by the Office of Civil Rights. While great care has been taken to assess the provision of athletic facilities according to the guidelines issued by this office, considerable interpretation on the part of the investigator was required.

Quality And Availability Of Facilities

The University has examples of well planned and beautiful intercollegiate athletic facilities; however, the quality of athletic facilities varies greatly by sport. Men's and women's basketball and volleyball have an excellent practice and competitive events facility in the Coliseum. The Stadium is an outstanding facility for football. Baseball has a practice and game facility that appears to be marginal and in need of significant improvements regarding concessions, the first base overthrow area (now a quonset hut peppered with dents), the public address system (portable), the scoreboard, and field lighting. Softball uses a city softball field that is inadequate in several respects including fencing, dugouts, concessions, public address system, spectator seating, parking, and lighting, to name a few. Golf uses off-campus courses at private country clubs and therefore has top-quality practice and tournament facilities. The Track and Field Events Center is an excellent venue. The Tennis Complex has well constructed courts but is shared with intramural events and recreational players and lacks adequate lighting, storage and a locker room.

None of these deficiencies alone indicate discrimination on the basis of gender. The facilities were compared as to quality and availability. This comparison was not performed team by team; rather, the facilities for men's teams were compared across the board to those provided to women.

While facilities differ more by sport than by gender, it is concluded that the

University does not offer practice and competitive facilities of equivalent quality to men and women. While improvements to most facilities are needed, these major findings led to this conclusion:

> The lack of a softball field for the women's team is a major factor that cannot be overlooked. The sharing of a public facility causes scheduling problems and decreases the availability of the facility for both practice and games. Even if this field was not shared, its condition alone would support the conclusion that the provision of facilities is not equitable. (According to the Athletic Director, an on-campus facility is planned. If built to a standard equivalent to the construction of the newer men's sports facilities on campus, this stadium may make a significant contribution towards achieving equity).
>
> Women's tennis shares their facility with intramural sports and with recreational players. No other sport shares a university owned facility in this manner. Sharing limits availability and player access.

Volleyball, along with men's and women's basketball, share the Coliseum for both practice and events. While coaches are very cooperative and attempt to accommodate the needs of each team, practice hours are limited. This effect was noted but judged to be equivalent in its impact on men and women.

Overall, both the quality and availability of practice and competitive facilities provided to women is less than those provided to men.

Quality And Availability Of Locker Rooms

Inequity in the provision of locker facilities to men and women was found. Several situations led to this finding:

> Overall, the quality of the locker rooms provided to female athletes is inferior to the quality of the men's locker rooms. Difference in the appearance of lockers, storage facilities, showers, and furnishings is obvious.
>
> The women's tennis team lacks a locker room and stores team equipment and player belongings in milk crates housed in a storage shed.
>
> The lack of a university owned softball facility means lockers are not accessible to the softball team.
>
> Softball players have no access to rest rooms while playing.
>
> The volleyball team has an inadequate number of showers for the squad size; some showers have been fenced off and are used for equipment storage.

Overall the men's teams have superior locker facilities: no men's team lacks a locker room and the location of men's locker rooms is more convenient. The overall quality and availability of locker rooms for male teams is superior to those offered to females.

Maintenance And Preparation Of Practice And Competitive Facilities

Facilities maintenance differs tremendously across the sports offered. In some sports, notably softball and baseball, the athletes perform a significant amount of the daily maintenance by participating in watering, trash pick-up and field preparation.

No gender difference in participation in these maintenance chores was found, but

differences between the sports exist. Some coaches require the participation of athletes in these duties, while in other sports the athletes do not participate at all. The fact that no differences exist between male and female athletes is attributed to coaching philosophies rather than to a policy adopted by the Department of Athletics.

With regard to facilities maintenance two conditions indicate that discrimination on the basis of gender exists:

> The women's tennis team must share their facility with recreational players, consequently sharing maintenance costs with the Department of Recreational Sports. While other teams share facilities with each other, costs of repair and maintenance are not split with other departments within the University. This places a burden on the budget of the team that is not evident among men's teams.
>
> The women's softball team must rely on the City to mow and perform maintenance. While the City is cooperative and responsive, this condition is not experienced by any other team and is a major inconvenience.

The preparation of facilities for games, matches or events is not equal across all sports. Specific instances that lead to the conclusion that female athletes are not afforded the same support as men include;

> The softball coach and team has to set-up the facility shared with the City. This means that all player equipment as well as the portable public address system must be hauled to the field in a van and set-up by the players and coaches.
>
> Softball must erect a temporary fence for each game series and remove it when play is completed.

This study found that both male and female athletes are required by their coaches to participate in game preparation duties to an equitable extent.

Recommendations Concerning Athletic Facilities

The results indicate a substantive difference in the provision of athletic facilities to student athletes on the basis of gender. No evidence of intentional discrimination was found. It is suspected that the differences found are the consequence of emphasizing certain sports and having separate sport programs rather than a comprehensive athletic program. Several actions could produce equity.

> Proceed with the construction of a softball facility which offers athletes the same quality found in other sports facilities on campus and limit the use of this facility to the softball team. If use of the facility is not exclusive, softball must be given absolute priority over other users to be compliant with Title IX.
>
> The University should assign four courts to the tennis team. At present, sharing of these courts forces practice sessions to begin as early as 6:00 am.
>
> The tennis team should be provided a locker room, showers and storage adjacent to the court complex for their exclusive use.
>
> A schedule for the renovation of locker rooms should be developed. Renovation should be aimed at providing equivalent locker rooms to all athletes.
>
> The Athletic Department should develop policies and standards for the equitable involvement of athletes in facility maintenance and event set-

up. Participation in these activities should be governed by policy.

The provision and maintenance of facilities should be managed according to written guidelines, policies, and criteria and funded out of a central budget.

Work to develop an integrated athletic program that unites all sports under one umbrella.

Effective Accommodation of Student Interests & Abilities

Institutions must offer athletics programs that effectively accommodate the interests and abilities of students (Bonnette 1990). OCR uses three factors, applied consecutively, to assess participation opportunities:

1. Are participation opportunities for male and female students provided in proportion to their enrollment?

2. If not, can the institution show a history and practice of program expansion that is responsive to developing interests and abilities?

3. If participation opportunities are not equitable, and program expansion is not evident, can the institution document that the interests and abilities of the underrepresented gender have been accommodated?

To determine if the proportion of females enrolled in the university differs from the proportion of females participating in intercollegiate athletics, a *z-test* (Kanji 1993) was used. Summary statistics and results are presented in Table 7.

Table 7
Enrollment and Athletics Participation By Gender

	Enrolled			Participating In Athletics*	
	Number	Percent		Number	Percent
Females	6,723	54.2%		71	25.8%
Males	5,689	45.8%		204	74.2%
Total	12,412	100.0%		275	100.0%
			z-value=	2.389	

*Fall 1992 enrollment
*As per 1992-93 Official Team Rosters

Since the obtained *z value* (2.389) exceeds the critical value (1.96 at p=0.05), the proportion of women participating in intercollegiate sports significantly differs from the proportion enrolled. Given the absence of evidence showing that the present opportunities for participation by women meets the level of interest, and given that the university cannot demonstrate program expansion, the university is not in compliance with the requirements of Title IX.

Conclusion

This study is not meant to be an exhaustive analysis of all aspects of Title IX compliance. Violation of any one factor used to assess compliance does not mean that the university would be found in violation of Title IX if investigated. Instead, this study focuses on some gender equity issues with the hope that findings can lead to the improvement of the athletics program.

During the course of this study, it became apparent that many problems exist because the University has promoted individual sports instead of the development of an unified athletic program supporting all sports. Athletics is by definition competitive and incentives for teams are important; however, when these incentives translate into practices that differ in their effect on male and female athletes, unintentional discrimination may be the result.

The Athletics Department has recognized the need to reduce the gap between genders in its programs, practices and activities. As components of this study have been completed, findings have been provided to the university administration and the Athletics Department. Both have demonstrated a commitment to move towards equity in intercollegiate athletics by the following:

A temporary softball field has been constructed on campus. Funds are being raised for a permanent softball facility.

Locker facilities for women's teams have been remodeled and updated.

Travel practices have been changed to be more equitable.

A study of student athletic interests has been proposed.

The increase of women's squad sizes to allow greater participation opportunities has been accomplished.

Scholarship awards to female athletes have been increased.

While studies in all areas covered by Title IX have not been completed, the focus on athletics produced by this internal study of Title IX compliance has produced results in other areas as well. Some of these changes are listed below:

An assistant coach has been added to the women's basketball team.

Salaries paid to women's team coaches have been reviewed and adjusted.

All head coaches are now on a twelve month contract.

The university is committed to equity through improvement of the treatment of women's sports without the decimation of men's sports, a consequence feared by critics of Title IX and the equity movement. Additional studies of other areas relevant to gender equity in intercollegiate athletics are planned.

References

American Alliance for Health, Physical Education, Recreation and Dance, National Association for Girls and Women in Sport. (1992). NAGWS Title IX Toolbox. Reston, VA

American Association of University Women Educational Foundation. (1992). How Schools Short Change Girls. Wellesley College, MA: Center for Research on Women. (ERIC ED 339 674)

Associated Press. (1993 August 7). "NCAA shoots down gender equity mandate." Houston Post, C-1.

Bonnette, B.M. (1990). Title IX Athletics Investigator's Manual. Denver, CO: United States Department of Education, Office of Civil Rights.

Bornstein, R. (1981). Title IX Compliance and Sex Equity Definitions, Distinctions, Costs, and Benefits. New York, N.Y.: Teacher's College, Columbia University. (ERIC ED 202 948)

Carpenter, L.J. (1993) "Letters Home: My Life With Title IX." Women In Sport: Issues and Controversies. Ed. Cohen, G.L. Newbury Park, CA.

Department of Health, Education and Welfare, Office of Civil Rights (1979). Title IX of the education amendments of 1972; a Policy Interpretation; Federal Register, 44: 239.

"Governmental Affairs Report." NCAA News 19 January 1994: 20.

"Immediately Effective Legislation Published." NCAA News 26 January, 1994:1-2

Irwin, C.C. (1992). Research Methodologies Used in Women's Gender-Equity Studies. Detroit, MI: Wayne State University, College of Education. (ERIC ED 343 957)

Kanji, G.P. (1993). 100 Statistical Tests. Newbury Park, CA: Sage Publications.

Lyndon B. Johnson School of Public Affairs. (1993). Gender Equity in Intercollegiate Athletics: The Inadequacy of Title IX Enforcement by the U.S. Office of Civil Rights (working paper No. 69). Austin, Tx: The University of Texas at Austin, Lyndon B. Johnson School of Public Affairs, Gender Equity in Intercollegiate Athletics Project.

Murdaugh, A.W., & Rebell, M.A. (1992). National Values and Community Values Part I: Gender Equity in the Schools. Journal of Law and Education, 21(2): 155-202.

National Collegiate Athletic Association. (1992). NCAA Gender Equity Study: Summary of Results. Overland Park, KS: National Collegiate Athletic Association. (ERIC ED 345 593)

National Collegiate Athletic Association Gender-Equity Task Force. (1993). Preliminary Report From the NCAA Gender-Equity Task Force. Overland Park, KS: Author.

Oberlander, S. (1988) 16 Bias Complaints Against 12 Athletics Departments Filed in Wake of Civil Rights Restoration Act. Chronicle of Higher Education, 2 November 1988: A33-34.

Stromquist, N.P. (1989). The State and Gender Equity in United States Education. Cambridge, MA: Annual Meeting of the Comparative and International Educational Society. (ERIC ED 315 850)

Tittle, C.K. (1985). Research on Sex Equity in Education: An Agenda For the Divisions, SIGs, and AERA. Educational Researcher, 14: 10-18.

BEST COPY AVAILABLE

Vargyas, E.J. (1989). Title IX Today. Strategies: A Journal for Sport and Physical Education, 2: 9-11.

Villalobos, P.M. (1990). The Civil Rights Restoration Act of 1987: Revitalization of Title IX. Marquette Sports Law Journal, 1: 149-169.

Uses & Abuses of Statewide Student Tracking

by

Dave Allen, Ph.D.
Director of Institutional Planning, Assessment and Research

Angelo State University

Paper Presented at the
TAIR Conference
El Paso, TX

February 23, 1994

Table of Contents

Introduction 1

Purpose 1

Literature Review 2

Method of Inquiry 2

Population 3

Findings 4

Discussion 5

References 7

Appendix 8

TAIR 1994 Paper

Uses and Abuses of Statewide Student Tracking

Dave Allen

Student tracking is more than a numbers game. If "signs-of-the-time" are any indication, student migration within higher education in the 90s will be directly linked to educational achievement —and funding. At a time when external agencies (i.e., LBB, NCAA, etc.) are demanding evidence of the college persistence process (and products, I might add), it is imperative that IR be able to track students beyond their own institutions. Taking advantage of "on demand" student tracking provided by the Texas Higher Education Coordinating Board, should not only help us "answer the mail" from external agencies but enhance our understanding of the process that affects students' decisions to remain in college. This paper is about one institution's experience with such a tracking system.

Purpose

This paper reports the results of a cooperative effort between Angelo State University (ASU) and the Texas Higher Education Coordinating Board (THECB). Specifically, this study tracks two consecutive cohorts (i.e., 1986 and 1987) of freshmen throughout public institutions in Texas six years after their initial entry into college. Implications for intervention strategies are discussed.

Literature Review

Why students drop out of college has been an educator's conundrum for decades. Tinto (1975, 1987) advocated longitudinal, explanatory approaches as key to understanding student departure. Allen and Nelson (1989) tested his model at two institutions and concluded that future validations would do well to disaggregate institutional withdrawal behavior at the highest level of specificity. Pascarella and Terenzini (1991) reviewed roughly 2,600 pieces of research. Their synthesis spanning the sixties through the seventies and eighties concludes that institutional assessment measures related to retention and graduation rates are here to stay.

Method of Inquiry

Two cohorts of first time and full time freshmen from the fall of 1986 and the fall of 1987 were each tracked for six years through May of 1992 and 1993, respectively. With the help of a new tracking system developed by THECB, coupled with our own in-house Retention and Management System (RAMS), five main questions will be answered:

1. How many received baccalaureate degrees from our institution?
2. How many received baccalaureate degrees from another public institution in Texas?
3. How many did not graduate but are still enrolled at our institution?

4. How many did not graduate but are still enrolled at another public institution in Texas?

5. How many did not graduate and are not currently enrolled in any public institution in Texas?

Appendix 1 displays the 17 field file description used by the THECB. User institutions are required to provide FICE codes and student identification numbers.

Appendix 2 is a sample student tracking output file. The sample shows a student who was deleted from the cohort since he was not a first-time college student in Fall 1986 at ASU. In fact, he had 63 semester credit hours prior to enrolling at ASU.

Appendix 3 is the actual SPSS program used to analyze the data received from the THECB. This program takes into account the fact that students had multiple records, one for each semester of enrollment.

Population

Cohort 1 consisted of 852 first-time, full-time freshmen who were identified from the fall 1986 entering class. In Cohort 2 there were 1,017 first-time, full-time freshmen who entered in fall 1987. First-time indicates they had no previous college record of attendance. Full time is defined as an enrollment in the fall of 12 hours or more. Freshmen who enrolled during the summer and continued as full timers that subsequent fall were included in the cohort. Cohorts 1 and 2 were tracked for six years through May graduation of 1992 and 1993, respectively.

Findings

Cohort 1: (1986)

Of 852 freshmen, six years later 305 (or 35.8%) had received either a certificate, an Associate's degree, Bachelor's degree, or Master's from some public institution of higher education in Texas. Table 1 (Appendix 4) demonstrates the education pattern for the 305 ASU freshmen who eventually received a certificate or degree. Overall, 209 (or 24.5%) received a baccalaureate or higher from ASU.

Table 2 (Appendix 5) depicts comparison data by category. As shown, 9% received degrees outside of ASU. Interestingly, nearly a tenth (8.1%) were still enrolled at ASU six years after initial entry. Perhaps the most dramatic finding is that nearly half (45.3%) had not graduated or were not enrolled anywhere in Texas public higher education as of May 1992.

Figures 1 (Appendix 6) uses a pipeline analogy to demonstrate student flow through the Texas higher education system. It demonstrates emphatically that students who fail to persist at ASU tend not to graduate at any public Texas higher education institution. Figure 2 (Appendix 7) is a further elaboration of the same data. Historically, the national ratio since the early part of this century for students graduating from any college, anytime is one in two.

Cohort 2: (1987)

Of 1,017 freshmen, six years later 490 (or 48.2%) had received either a certificate, an Associate's degree, Bachelor's degree, or Master's from some public institution of

higher education in Texas. Figure 3 (Appendix 8) demonstrates the education pattern for the 490 ASU freshmen who eventually received a certificate or degree. Overall, 329 (or 32.4%) received a baccalaureate or higher from ASU.

Figure 4 (Appendix 9) shows that 14% of all who dropped out of ASU had earned a certificate or higher by fall 1993. Perhaps the most dramatic finding is that nearly 331 (32.5%) had not graduated or were not enrolled anywhere in Texas public higher education through fall 1993. This almost exactly matches the number who received a bachelor's or higher from ASU.

Figure 5 (Appendix 10) represents a two cohort composite of the data. What is obvious here is that the numbers of ASU Bachelor's or above recipients increased from the 1986 cohort to the 1987 cohort. The number not graduated and not enrolled showed an opposite trend.

Discussion

This study represents two cohorts six years after entry. What is unique about it is that students are tracked over time throughout all public higher education institutions in Texas. As a result of these tracking efforts, the broader segment of the ASU community is more aware of the graduation rate problem than they would have been without the study. As a result of this awareness, an intervention strategy was implemented from ASU's Office of Institutional Planning, Assessment and Research. A phonathon was organized and students who were identified as highly dropout prone

yet open to institutional help were contacted. Over 25 faculty and staff served as volunteers. In order to identify dropout prone students, the College Student Inventory (CSI) produced by the Noel & Levitz Center's for Institutional Effectiveness was administered. Just over a fourth (26.1%) of 751 ASU students were identified from the CSI as "students with high dropout proneness." This CSI Phonathon effort is one way institutions can take results from a tracking mechanism one step further. The CSI project is in progress with results forthcoming.

Findings from this study have several implications. First, the results underscore the need for institutions to carefully monitor data about their institution as reported from external sources. The THECB reported student flow data from the fall 1986 cohort which did not match data replicated in this study. The THECB data set included students who did not belong to the fall 1986 cohort, were part time, and/or had transfer hours. After data screening, the original set from the THECB was reduced from 1,068 to 852 first-time, full-time fall 1986 freshmen.

Secondly, studies like these have the potential of dispelling myths about what happens to students when they leave an institution. ASU is a university that still has a reputation as a place from which students transfer. Data here demonstrated that less than 12% from either cohort achieved a bachelor's degree or beyond once they withdrew from ASU.

And thirdly, it should be emphasized that graduation rate studies are strictly "outcomes" oriented and in no way reflect the true effectiveness of an institution. What

studies like this omit are data concerning the success rate of students who transfer into an institution. Also omitted are "input" factors regarding who an institution admits to begin with. As Alexander Astin recently pointed out (Chronicle of Higher Education, Sep 22, 1993, A48), the Student Right to Know and Campus Security Act of 1991 may have created a strong disincentive for institutions to recruit underprepared students (including poor students and those from underrepresented minority groups).

In the final analysis, a balance needs to be struck between input data on students when they first enroll and subsequent outcome scores.

References

Allen, D. and Nelson, J. (1989). Tinto's Model of College Withdrawal Applied to Women in Two Institutions. Journal of Research and Development in Education, 22, 1-11.

Pascarella, E. and Terenzini, P. (1991). How College Affects Students. San Francisco: Josey-Bass.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent work. Review of Educational Research, 45, 89-125.

Tinto, V. (1987). Leaving College: Re-thinking the Causes and Cures of Student Attrition. Chicago: University of Chicago Press.

For more information contact:
Dave Allen
Director of Institutional Planning, Research and Assessment
Angelo State University
San Angelo, Texas 76909
(915) 942-2259

APPENDIX

File Description 1

Sample Student Tracking Output File 2

SPSS/PC+ 4.0 Analysis Program 3

Degree Patterns by College 4

Graduation Rate Comparison 5

ASU Student Flow Model (1986 Cohort) 6

Six Year Graduation Patterns (1986 Cohort) 7

ASU Student Flow Model (1987 Cohort) 8

Six Year Graduation Patterns (1987 Cohort) 9

Two Cohort Comparison 10

FILE DESCRIPTION -- Student Tracking Output File

FLD NO.	BEG POS	FLD LEN	DATA TYPE	FIELD NAME and DESCRIPTION
1	1	1	N	Record Code (1=CBM001, 9=CBM009))
2	2	6	N	FICE Code
3	8	9	AN	Student Identification Number
4	17	1	N	Type of Institution 1=public senior, 3=public junior, 5=health
5	18	1	AN	Sex - M or F
6	19	1	AN	Classification (CBM001 only) Senior and health inst.: 1=freshman, 2=sophomore, 3=junior, 4=senior, 5=post bacc., 6=master's, 7=doctoral, 8, 9, 0, M=special/professional Junior inst.: 1=freshman, 2=sophomore, 3=unclassified
7	20	4	N	Date of Birth - MMYY
8	24	3	AN	Residence (CBM001 only)
9	27	2	N	SCH Enrolled (CBM001 only)
10	29	1	N	Ethnicity
11	30	1	N	Semester Senior and health inst.: 1=fall, 2=spring, 3=summer Junior inst.: 1=fall, 2=spring, 3=summer I, 4=summer II
12	31	2	N	Year CBM001 data: last 2 digits of the calendar year in which the semester occurs CBM009 data: last 2 digits of the fiscal year in which the degree or certificate was conferred
13	33	8	AN	Major Code
14	41	1	N	Type of Major 1=academic, 2=technical, 3=adult vocational
15	42	1	N	Level of Degree (CBM009 only) Senior and health inst.: 1=associate, 2=baccalaureate, 3=masters, 4=doctoral, 5=special/professional Junior inst.: 1=associate, 2=certificate
16	43	8	AN	Degree Conferred (CBM009 only)
17	51	14	AN	Status Will contain "DID NOT LOCATE" if no student ID match was found. FICE code and student identification number will contain the values originally submitted.

GRADUATION RATE THECB FOLLOW-UP: FULL-TIME COHORT FALL 1986

3:01 Thursday, November 12, 1992

STUDENT: RUSSELL F. (ENTERED: FALL 84; GRAD: AUG 89, ASU)

OBS	CBSM	FICE	SSN	TYPE	LSAT	SOC	RESC	SCHE	RSAS	MAJR	TMAJ	LMDG	DEGU	STAT	
1	1	3549	255299516	3 M	1	266	101	17	1 1	84	14010100	1	.		BLINN COLLEGE (FALL 84)
2	1	3549	255299516	3 M	1	266	101	17	1 2	85	14010100	1	.		
3	1	3549	255299516	3 M	1	266	101	16	1 1	85	14010100	1	.		
4	1	3549	255299516	3 M	1	266	101	13	1 2	86	14010100	1	.		
5	1	3541	255299516	1 M	2	266	101	16	1 1	86	06010100	1	.		ASU (FALL 86)
6	1	3541	255299516	1 M	3	266	101	16	1 2	87	06010100	1	.		
7	1	3541	255299516	1 M	3	266	101	16	1 1	87	06010100	1	.		
8	1	3541	255299516	1 M	4	266	101	13	1 2	88	06010100	1	.		
9	1	11711	255299516	1 M	4	266	101	3	1 3	88	06040110	1	.		U. OF H-CLEAR LAKE (SUM 88)
10	1	90	255299516	3 M	3	266	101	3	1 4	88	06010100	1	.		SAN JACINTO COLLEGE-S. CAMPUS (SUM2 88)
11	1	11711	255299516	1 M	4	266	101	6	1 1	88	06040110	1	.		U. OF H-CLEAR LAKE (FALL 88)
12	1	3652	255299516	1 M	4	266	101	6	1 2	89	06040100	1	.		U. OF H-MAIN (SP 89)
13	9	3541	255299516	1 M	.	266	000	0	1 1	89	06040110	1	2	BBA	ASU (AUG 89)

Appendix 3

```
June 23, 1993

PROGRAM:  ASU86.SPS      BY: DAVID ALLEN, PH.D.

SPSS/PC+ 4.0

DATA LIST FILE 'ASU862.DAT' FIXED /
  CBM 1 FICE 2-7 SSN 8-16 (A) TYPE 17 SEX 18 (A) CLASS  19
  DOB 20-23 RES 24-26 (A) SCH 27-28 RACE 29 SEM 30 YR 31-32
  MAJ 33-40 (A) TMAJ 41 LDEG 42 DEG 43-50 (A) STATUS 51-64 (A
  NEWFICE 65-70 SSN1 8 (A) SSN3 8-10 (A).

COMPUTE SCHLFY=0.
COMPUTE SAMEYR=99.
COMPUTE DIFFYR=99.
COMPUTE SCHLFY=YR.
COMPUTE NEWFICE=FICE.

IF (FICE=3541)     NEWFICE=3541.
IF (FICE NE 3541) NEWFICE=9999.

IF (SEM=6 AND YR NE 86)       SCHLFY=SCHLFY+1.
IF (CBM=9 AND FICE NE NEWFICE) DIFFYR=SCHLFY.
IF (CBM=9 AND FICE=NEWFICE)    SAMEYR=SCHLFY.

AGGREGATE OUTFILE=*
 /PRESORTED
 /BREAK=FICE,SSN
 /SCHLFY=MAX(SCHLFY)
 /SEX,RACE,SCH,SSN1,SSN3=FIRST(SEX,RACE,SCH,SSN1,SSN3)
 /NEWFICE=LAST(NEWFICE)
 /SAMEYR,DIFFYR=MIN(SAMEYR,DIFFYR).

COMPUTE CATEG=0.
IF (SCHLFY >= SAMEYR AND FICE=3541)                CATEG=1.
IF (SCHLFY >= SAMEYR AND FICE NE 3541)             CATEG=2.
IF (SCHLFY=92 AND SAMEYR=99 AND FICE=3541)         CATEG=3.
IF (SCHLFY=92 AND SAMEYR=99 AND FICE NE NEWFICE)   CATEG=4.
IF (SCHLFY < 92  AND SAMEYR=99)                    CATEG=5.


AGGREGATE OUTFILE=*
  /PRESORTED
  /BREAK=SSN
  /SCHLFY=MAX(SCHLFY)
  /SEX,RACE,SCH,SSN1,SSN3=FIRST(SEX,RACE,SCH,SSN1,SSN3)
  /NEWFICE=LAST(NEWFICE)
  /FICE=LAST(FICE)
  /SAMEYR,DIFFYR=MIN(SAMEYR,DIFFYR)
  /CATEG=LAST(CATEG).

VALUE LABELS CATEG 1 'ASU DEG' 2 'NON-ASU DEG' 3 'ASU SCHL FY92'
                   4 'OTHER SCHL FY92' 5 'NO SCHL FY92'.

VALUE LABELS RACE 1 'WHITE' 2 'BLACK' 3 'HISPANIC' 4 'A/PI' 5 'AI/AN' 6 'INT
CROSSTABS TABLES=CATEG BY RACE / OPTIONS 3 4.
FINISH.
```


BEST COPY AVAILABLE

Table 1

ASU Fall 1986 Freshmen Cohort (N=852)
Degree Patterns by College

Highest Education Earned		Number	Percent
Certificate		2	0.7%
Associate Degree		18	5.9%
Bachelor's Degree		282	92.4%
Master's Degree		3	1.0%
	TOTAL	305	100.0%
CERTIFICATE	(N=2)		
Howard – Big Spring CC		1	50.0%
Texas State Technical College – Waco		1	50.0%
		2	100.0%
ASSOCIATE DEGREE	(N=18)		
ASU		6	33.3%
Cisco CC		2	11.1%
Howard – Big Spring CC		1	5.6%
Midland CC		1	5.6%
S Plains CC		2	11.1%
SWT CC		1	5.6%
Tarrant South CC		1	5.6%
Texas State Technical College – Sweetwater		2	11.1%
Texas State Technical College – Waco		1	5.6%
Vernon CC		1	5.6%
		18	100.0%
BACHELOR'S DEGREE	(N=282)		
ASU		207	73.4%
A&M		13	4.6%
A&M Vet Under		1	0.4%
ETSU – Tx		1	0.4%
Midwest		1	0.4%
SFAU		2	0.7%
SHSU		4	1.4%
SRSU		3	1.1%
SWTS		3	1.1%
Tarleton		10	3.5%
Tx Tech		13	4.6%
TWU		1	0.4%
UH		1	0.4%
UH – Clearwater		2	0.7%
UNT		2	0.7%
UT		3	1.1%
UT – AR		4	1.4%
UT – Dal Al Hlth		1	0.4%
UT – Dallas		3	1.1%
UT – Gal Al Hlth		2	0.7%
UTEP		1	0.4%
UTPB		2	0.7%
UTSA		2	0.7%
		282	100.0%
MASTER'S DEGREE	(N=3)		
ASU		2	66.7%
Tx A&M		1	33.3%
		3	100.0%

Table 2

ASU Graduation Rate Comparison – First Time Entering Freshmen, Fall 1986
Enrolled for 12 or more SCH (through May 1992)

	ASU (N=852)						
	RACE						
	W	B	H	As	In	Int	Total
1. Baccalaureate or Above Graduates ASU	174	5	27	2	0	1	209
	83.3%	2.4%	12.9%	1.0%	0.0%	0.5%	100.0%
	24.9%	17.2%	23.7%	33.3%	0.0%	33.3%	24.5%
2. Baccalaureate or Above Graduates Another Institution	75	0	1	0	0	0	76
	98.7%	0.0%	1.3%	0.0%	0.0%	0.0%	100.0%
	10.7%	0.0%	0.9%	0.0%	0.0%	0.0%	8.9%
3. Did not graduate, still enrolled at ASU 1991–92	58	1	9	0	0	1	69
	84.1%	1.4%	13.0%	0.0%	0.0%	1.4%	100.0%
	8.3%	3.4%	7.9%	0.0%	0.0%	33.3%	8.1%
4. Did not graduate, still enrolled at another institution 1991–92	70	3	18	1	0	0	92
	76.1%	3.3%	19.6%	1.1%	0.0%	0.0%	100.0%
	10.0%	10.3%	15.8%	16.7%	0.0%	0.0%	10.8%
5. Did not graduate, not currently enrolled 1991–92	322	20	59	3	1	1	406
	79.3%	4.9%	14.5%	0.7%	0.2%	0.2%	100.0%
	46.1%	69.0%	51.8%	50.0%	100.0%	33.3%	47.7%
TOTAL	699	29	114	6	1	3	852
	82.0%	3.4%	13.4%	0.7%	0.1%	0.4%	100.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes:

1. Students who graduated from ASU with bachelor's or above degree.
2. Students who graduated from another institution with bachelor's or above degree.
3. Students who have not graduated with a bachelor's or above degree, but are still enrolled at ASU.
4. Students who have not graduated with a bachelor's or above degree, but are still enrolled at another institution.
5. Students who have not graduated with a bachelor's or above degree and are not currently enrolled in any institution.

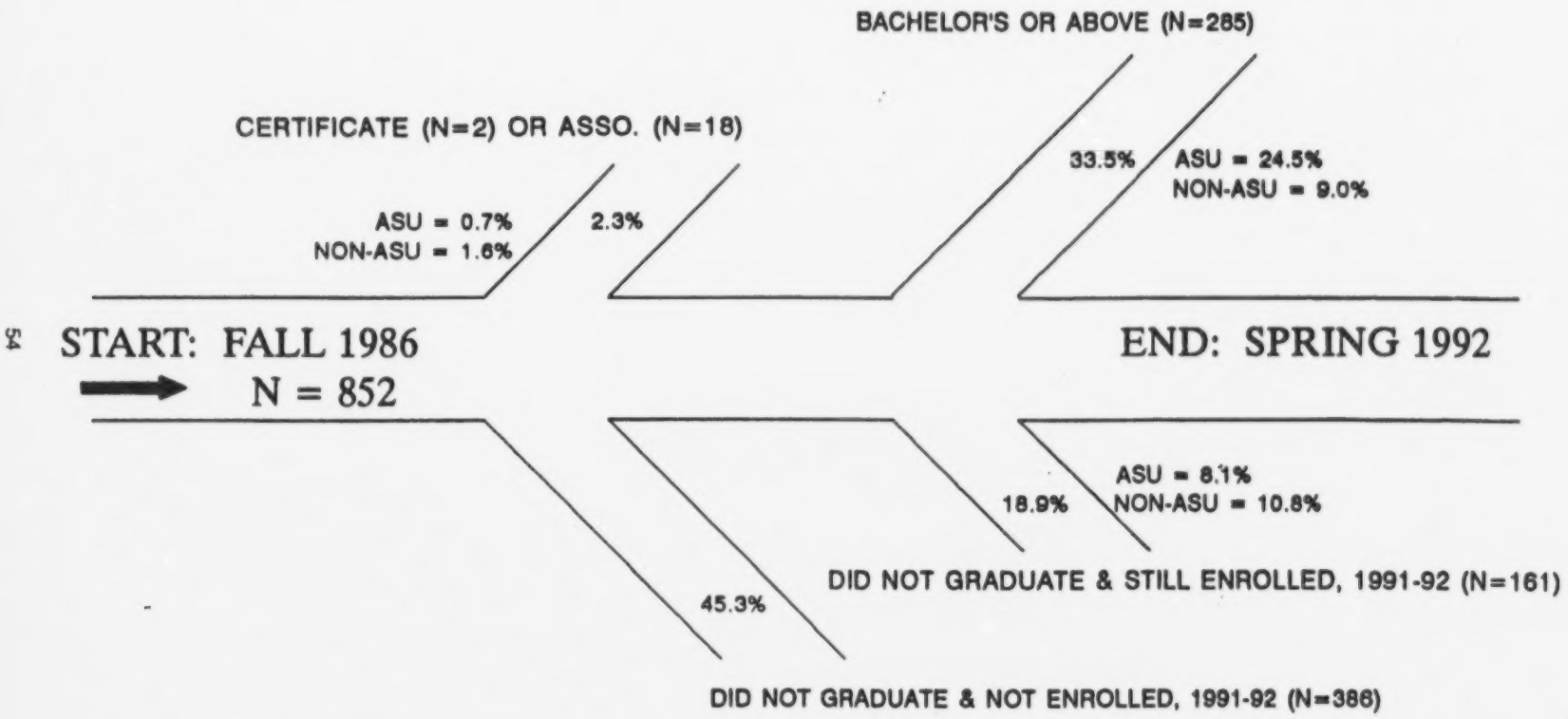
Legend
Row PCT
Col PCT

Sources: ASU Office of Institutional Planning
Assessment & Research
THECB (Texas Higher Education
Coordinating Board)

Date: July 1993

FIGURE 1. ASU STUDENT FLOW MODEL

SIX YEAR GRADUATION RATES (THRU SPR 92)
FALL 1986 FIRST-TIME, FULL-TIME FRESHMEN (N=852)



SOURCES: ASU OFFICE OF INSTIT. PLANNING, ASSESS. & RESEARCH
TX HIGHER EDUCATION COORDINATING BOARD DATA SERVICE

DATE: JULY 1993

FIGURE 2. SIX YEAR GRADUATION PATTERNS FALL 1986 FRESHMEN (N=852) THRU SPR 1992

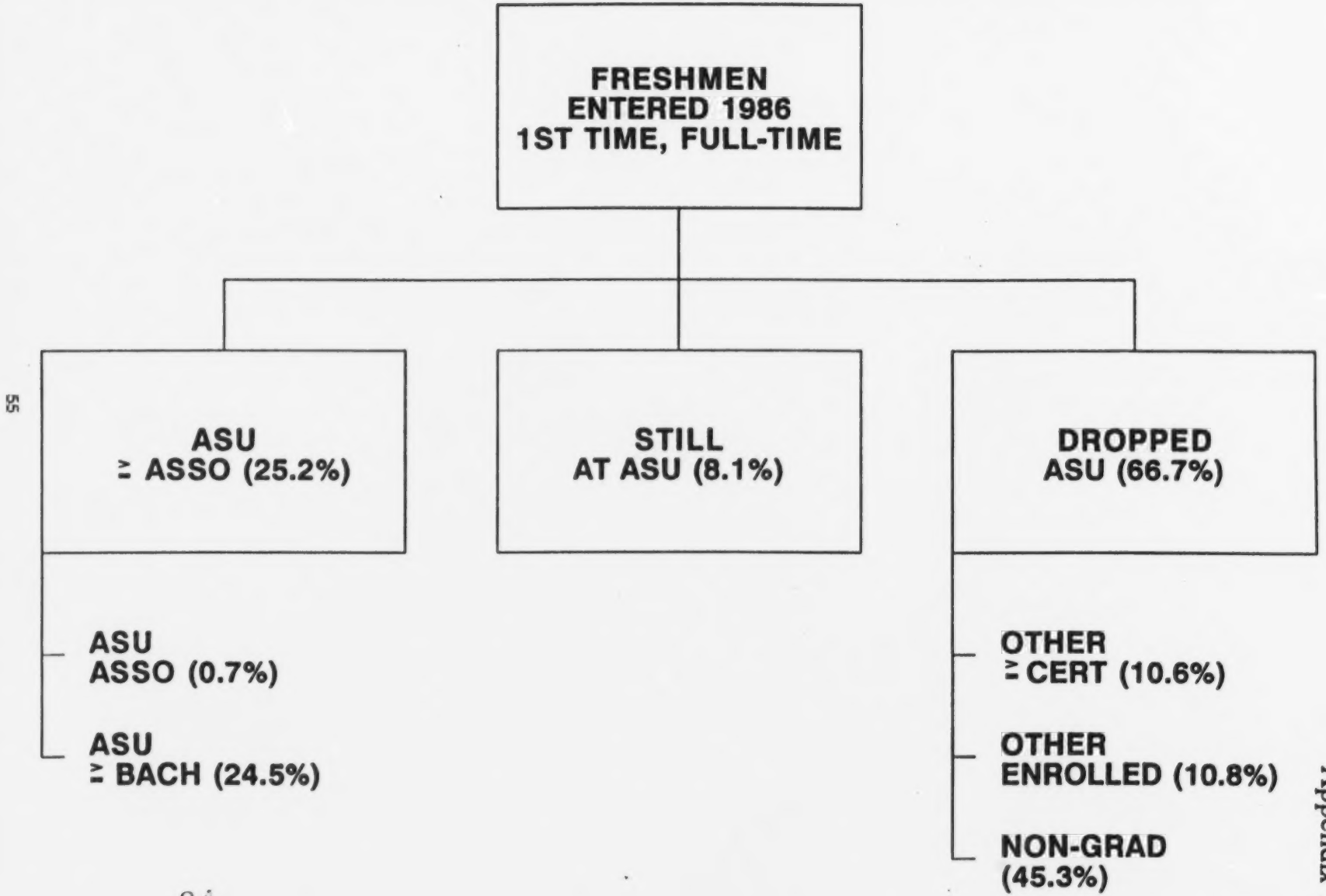
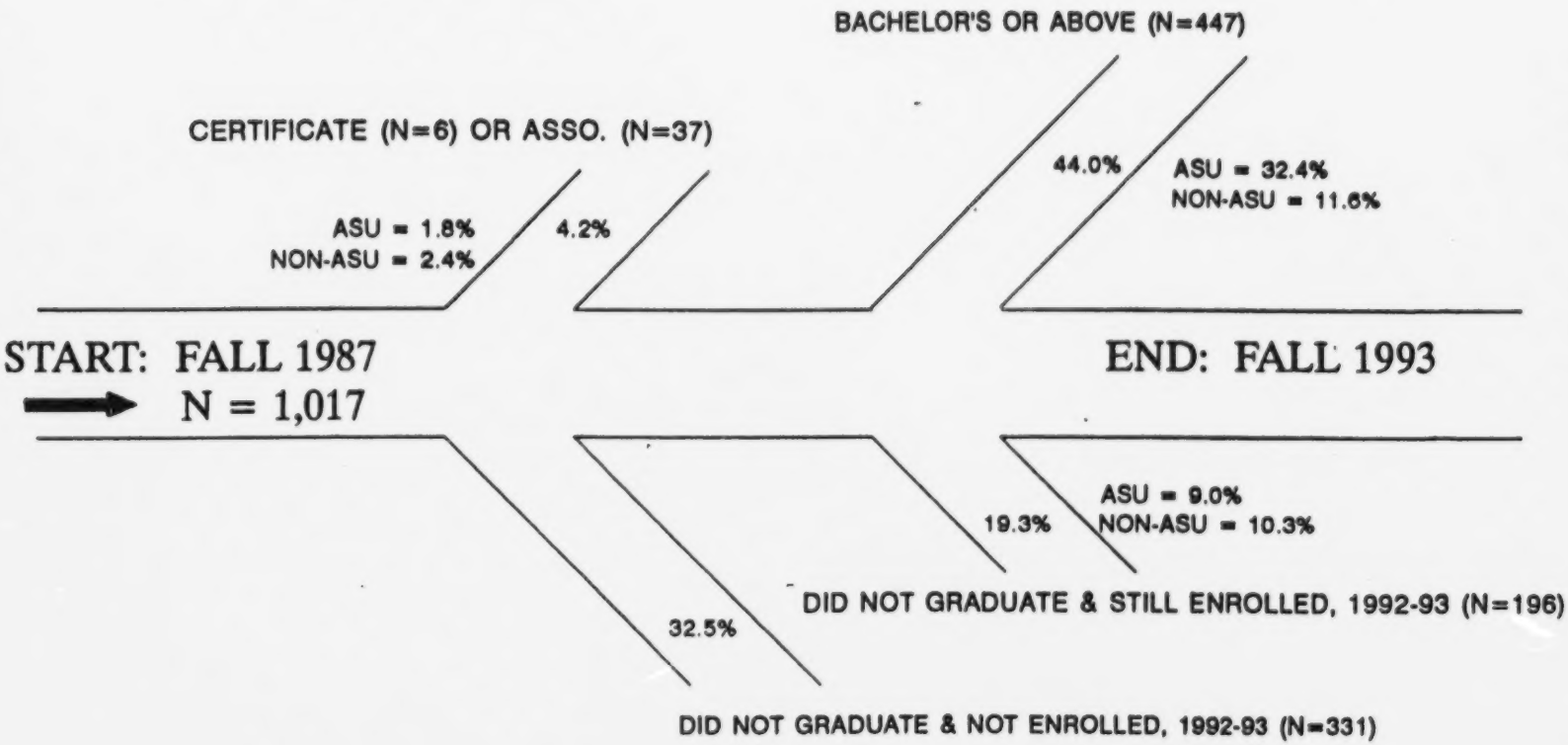


FIGURE 3. ASU STUDENT FLOW MODEL

SIX YEAR GRADUATION RATES (THRU FALL 93)
FALL 1987 FIRST-TIME, FULL-TIME FRESHMEN (N=1,017)



SOURCES: ASU OFFICE OF INSTIT. PLANNING, ASSESS. & RESEARCH
TX HIGHER EDUCATION COORDINATING BOARD DATA SERVICE

DATE: FEBRUARY 1994

FIGURE 4. SIX YEAR GRADUATION PATTERNS
FALL 1987 FRESHMEN (N=1,017) THRU FALL 1993

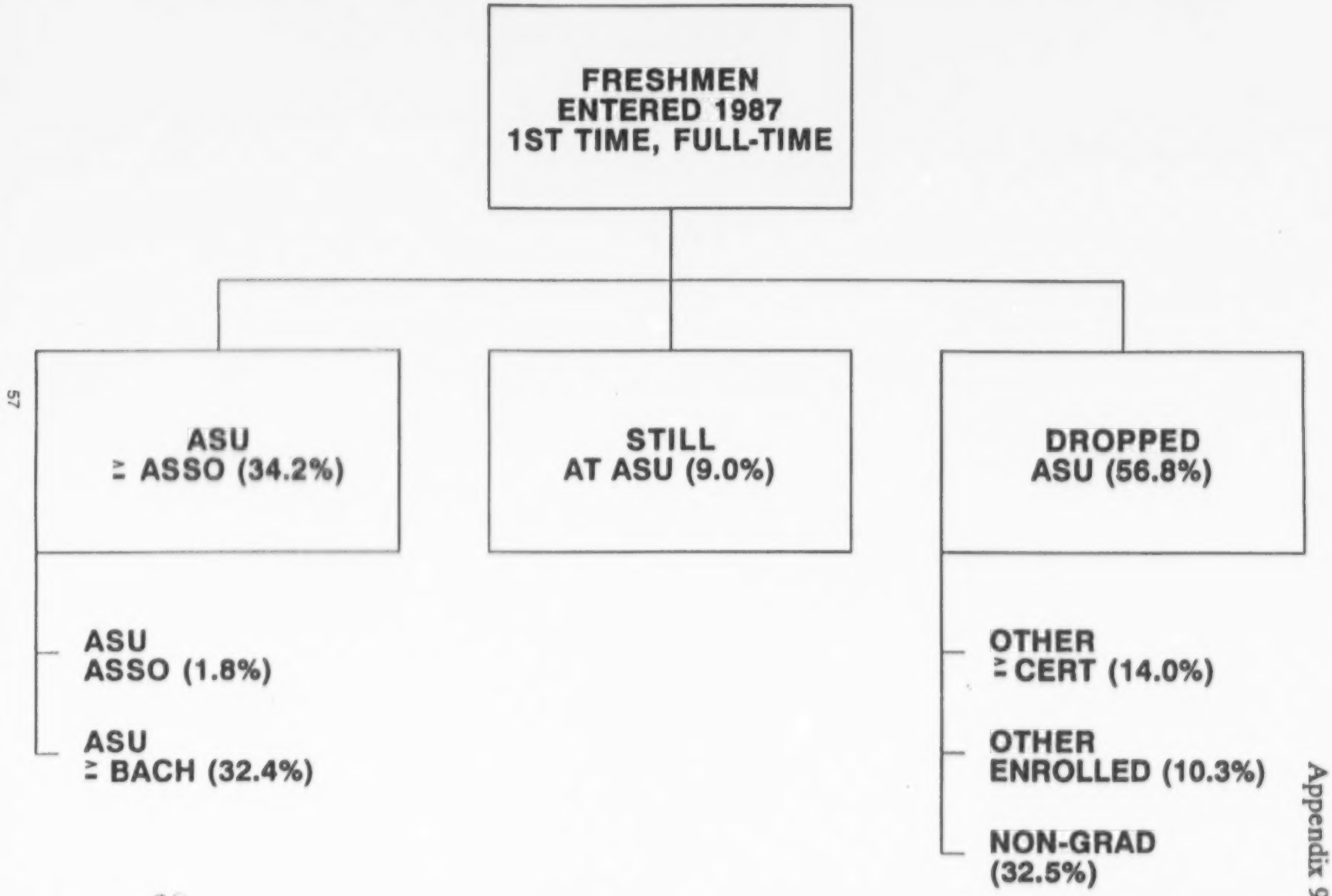
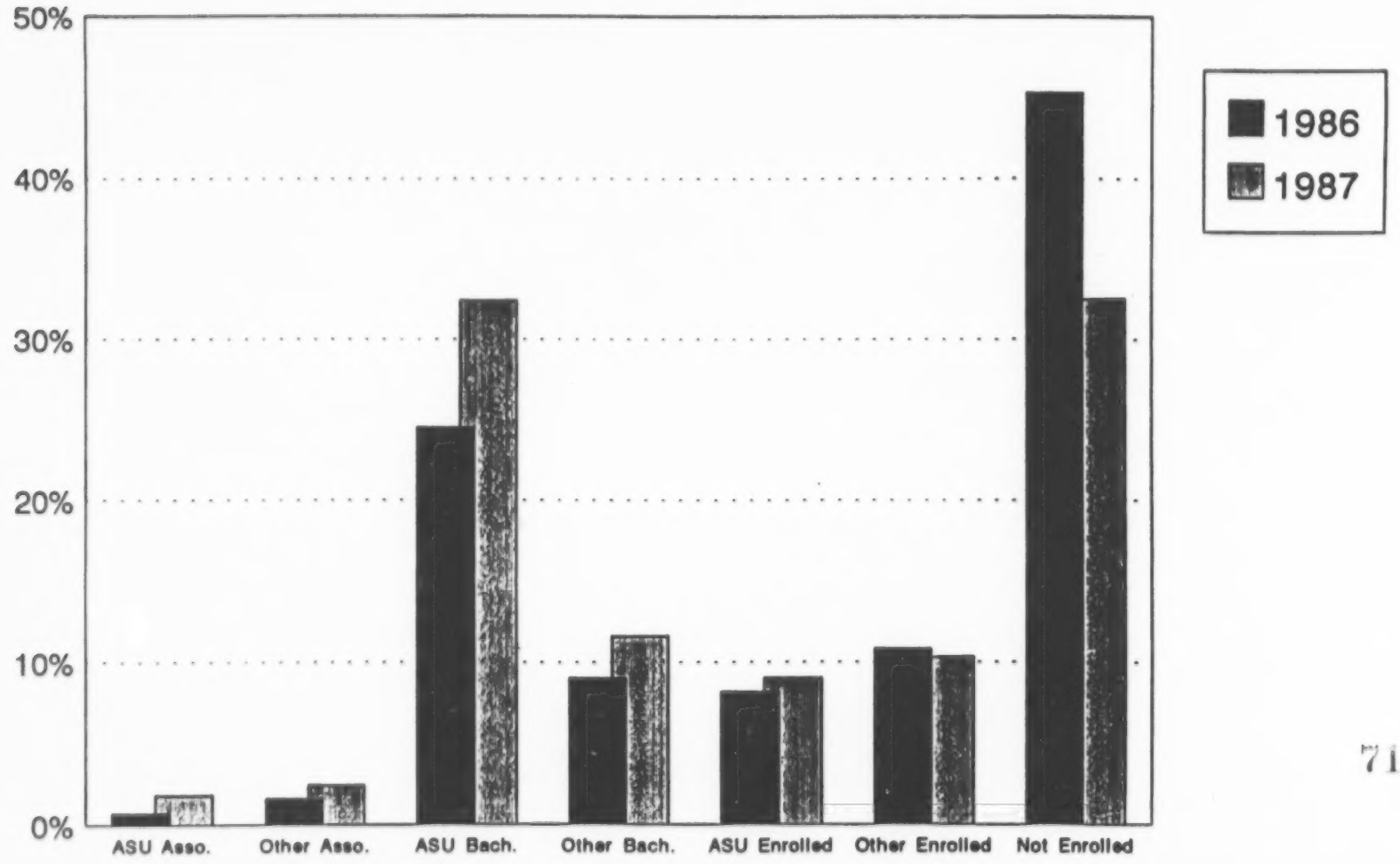


FIGURE 5. TWO COHORT COMPARISON

Six Year Graduation Rates of Freshmen
Fall 1986 & Fall 1987
(N = 852) (N = 1,017)



GETTING STARTED WITH SURVIVAL ANALYSIS:

An Application to Retention Data

by

Sharron L. Ronco
Director, Institutional Studies

University of Texas at El Paso
500 University Ave.
El Paso, Texas 79968
(915) 747-5207
Bitnet: AE05@UTEP

Paper presented at the annual meeting of the Texas Association for Institutional Research, College Station, TX, February 1993

GETTING STARTED WITH SURVIVAL ANALYSIS:
An Application to Retention Data

Background

Institutional researchers are often interested in studying events, such as the choice of enrollment in a particular institution, academic success, graduation, and dropout. By definition, an event must be preceded by a period of time during which the event did not occur; the prospective student did not enroll, the student did not graduate or drop out. Event history analysis is a technique used to study what happens to a cohort of individuals during that period of nonoccurrence. As such, it is somewhat misnamed, since it is actually the nonevent which is of interest; specifically, the duration of nonoccurrence.

Event history analysis seeks to predict duration from variables that describe the background, environment and treatment of a cohort of individuals. It treats time as an outcome instead of as a predictor. Rather than examining duration directly, however, event history strategies model two mathematical transformations of duration, the survivor function and the hazard function.

Event history analysis is really a collection of related methods. Much of the literature on event history methods goes under the name of survival analysis or lifetime analysis (Allison, 1984). The terminology used is borrowed from biostatisticians, who use survival methods to analyze clinical lifetime data. The methods have been extended by economists and sociologists to study other areas of social transitions, but the nomenclature remains foreboding and unfamiliar to institutional researchers, who are not accustomed to thinking of enrollment in college as a "risk" or graduation as a "hazard."

Because events are defined in terms of change over time, it is increasingly recognized that the best way to study events and their causes is to collect

event history data (Allison, 1984). It is more informative to study when transitions occur rather than whether they occur. When are students at greatest risk of dropping out? Does the profile of risk differ across groups? Do particular policies and practices have an impact? (Willett & Singer, 1991b). Characterizing what happens to students at critical junctures will help us devise ways to prevent unwanted "events."

Survival and Hazard

Survival analysis begins with the survivor function. The survivor function at time (t) is the probability that a randomly-selected member of the population will survive beyond time (t). At a survivor function of .50, for example, half of the individuals have experienced the target event, and half have not. A useful concept which is derived from the survivor function is the estimated median lifetime, which indicates how much time passes before half of a sample experiences the target event. Informative as it is, however, the survivor function is too crude a summary because it maintains a consistent shape regardless of the distribution of risk (Singer & Willett, 1991).

Risk is an important concept in survival analysis. Individuals who are not married, for example, are not at risk for divorce. Students who are not enrolled are not at risk for dropping out. Risk does not necessarily remain constant over the risk period. Research has shown, for example, that students are more likely to drop out during their first year of college than at other times.

A good way to assess risk is to examine the hazard function. The hazard is the number of new events occurring during a time period, expressed as a proportion of the number of individuals at risk. It is the probability that a randomly-selected member of the population will experience the event in the interval between (t) and (t+1) (Willett & Singer, 1988). Although the hazard is an unobserved variable, it controls both the occurrence and the timing of events. As such, it is the fundamental dependent variable in an event history model (Allison, 1984).

Why use survival analysis?

Researchers using conventional methods of analysis such as multiple linear regression or analysis of variance must know the value of the outcome for every person under study. If the outcome is not known by the end of the data collection period, then the event is "censored." In studying retention, for example, not every student will either graduate or drop out in six years; there will be persisters whose outcomes are censored. Censoring complicates research design and statistical analysis. If we group data into clusters, such as those who graduate after six years vs. those who don't, we obscure knowledge about transitions. The cutoff date of six years is arbitrary, and the variation that occurs on either side of the cutoff is wasted. In survival analysis, individuals whose time to dropout is censored contribute exactly what is known about them; specifically, that they did not drop out during the semesters during which they were observed. Survival analysis can even model all modes of exit simultaneously as a set of competing risks.

Another advantage of survival analysis is the ability to study time-varying predictors. These are variables that change in value over the observation period, such as grade point average, hours engaged in outside employment, financial aid, and academic or social integration. Time-varying predictors can capture important changes in a student's academic career over time. Finally, survival analysis has the ability to test whether a predictor has the same effect on two or more different groups over time.

In summary, simply computing a six-year graduation rate for a cohort of individuals sacrifices the following information: Variability in the timing of graduation for those students who experienced the event, information on those who did not graduate, and the impact of various factors on the probability and timing of graduation.

Selecting the Design

The researcher needs to make several decisions regarding design and method-

ology before undertaking survival analysis. These include:

Defining the time period: Deciding when to start the clock on data collection can be problematic for survival analysis, but in higher education research, most start dates are easily defined by the beginning of a quarter, semester or year. It is best to avoid start times which are left-censored (the start date occurs before the data collection period and is unknown). A finite, preselected period of time is chosen, which must be long enough for at least half of the sample to experience the target event during data collection (Singer & Willett, 1991).

Defining the target event: At every point in time, each individual in the cohort must occupy one, and only one, of two or more states. The states must be mutually exclusive (only one state can be occupied) and exhaustive (all possible states are included). The target event occurs when an individual moves from one state to another. States must be precisely defined and unambiguous. Whether or not the target event occurred becomes the dependent variable in the analysis.

Selecting independent variables: The independent variables (or predictors) to be included in the model are defined by the research questions posed. Time-invariant predictors describe background variables such as gender, race/ethnicity, parents' educational level, admission status, SAT scores, time since high school graduation, and so on. The information captured by these predictors remains constant over time. The values of time-varying predictors, on the other hand, can differ across time. Students may receive financial aid some semesters but not others. They may undergo remediation at certain times. Each semester's grade point average is a time-varying predictor.

Deciding whether time is continuous or discrete: Methods that assume that the time of event occurrence is measured exactly are known as "continuous-time" methods. If the units of time are very small, time is treated as though it were continuous. When events are measured on a larger scale, such as months, semesters or years, it is more appropriate to use discrete-

time methods. Data in higher education is often collected on a semester basis, so discrete-time methods are a logical choice. Discrete-time methods are easier to understand and implement than continuous-time methods, do not require dedicated software, can detect the interaction between time and predictors, and can be used to study competing risks. However, computational costs increase greatly with discrete-time methods since they require that the observation period for each individual be subdivided into separate units for each time of observation. Thus, if the research design includes no time-varying predictors and the units of time are small, continuous-time models should be considered.

Deciding whether hazards are proportional or nonproportional: In a proportional hazards model, the ratio of hazards of two individuals at any point in time is a constant. The hazard profiles of the two groups share the same shape and are separated only by a constant vertical distance on every occasion for which duration is known. But if a predictor has a different effect at different times, then the proportional hazards assumption is violated, and it becomes necessary to include an interaction term between the predictor and time. Although the proportional hazards assumption is extraordinarily general and nonrestrictive, it is seldom tenable. Singer and Willett (1991) advocate regarding the proportional hazards assumption as mythical in any set of data until proven otherwise. The proportional hazards assumption is tested by adding to the model an interaction with time and assessing the effect of this new predictor.

Examining Competing Risks: Instead of occupying one of two mutually-exclusive states, individuals can sometimes be at risk of experiencing one of several mutually-exclusive events. For example, students may leave a higher education institution through dropout, transfer to another school, or graduation. These three modes of exit are states which "compete" with each other to terminate enrollment. These modes of exit are clearly not equal, and the predictors associated with each mode are likely to be of interest to researchers. In competing-risk survival analysis, the researcher first models the risk of each event separately, then assembles a global profile to create an overall risk profile for all events taken

together (see Allison, 1984 and Yamaguchi, 1991 for techniques).

Studying Repeated Events: Some events are irreversible; once they occur, they cannot occur again. First-time-in-college and graduation are two such events. Other events, such as 'stopout' can occur over and over. When studying the timing of repeatable events, researchers should note the spell number, since the risk of occurrence of different spells may not be independent of each other. Repeated-spells data is complex, since both analyzing spell-by-spell and combined spell approaches may be inherently flawed (Allison, 1984; Singer & Willett, 1991).

APPLICATION OF SURVIVAL ANALYSIS TO RETENTION DATA

To illustrate a simple application of survival analysis in the postsecondary setting, data on a cohort of individuals who entered this institution in Fall 1986 was collected through Summer 1992. The cohort consisted of all first-time-in-college freshmen who identified their ethnicity as either Hispanic or white, non-Hispanic. To simplify the analysis, students who stopped out for one or more semesters were eliminated from the cohort. Ideally, stopout would either be coded as a form of exit or as an independent variable. Because the event of interest was leaving the university without attainment of an undergraduate degree, either graduating or being enrolled at the end of the data collection period were treated as censored events.

Two time-invariant predictors (ethnicity and admission status) and two time-varying predictors (full- or part-time enrollment and grade point average) were chosen for this analysis. Admission status was coded as 'regular' or 'provisional' admit. Grade point was dichotomized into 'less than 2.00' and '2.00 and above' at the end of each semester. The following research questions guided the analysis: How many years, on the average, does enrollment last? When are students at greatest risk of dropping out? Does the profile of risk differ for provisional students? For Hispanic students? Does the risk differ for full-time as compared to part-time students? How does the risk differ for students who perform poorly?

Original Person Data

ID	ETHNIC	PROV	GPA_1	GPA_2	GPA_3	GPA_4	$FPST_1$	$FPST_2$	$FPST_3$	$FPST_4$	GONE
01	1	1	1	.	.	.	1	.	.	.	1
02	0	0	0	1	1	.	0	0	1	.	1
03	1	0	1	1	0	1	1	0	1	1	0

Person-Period Data Set

ID	SEM_1	SEM_2	SEM_3	SEM_4	ETHNIC	PROV	GPA	FPST	GONE
01	1	0	0	0	1	1	1	1	1
02	1	0	0	0	0	0	0	0	0
02	0	1	0	0	0	0	1	0	0
02	0	0	1	0	0	0	1	1	1
03	1	0	0	0	1	0	1	1	0
03	0	1	0	0	1	0	1	0	0
03	0	0	1	0	1	0	0	1	0
03	0	0	0	1	1	0	1	1	0

ETHNIC:	PROV:	GPA :	FPST:	GONE:
1= Hispanic	1= Provisional	1= $\geq$ 2.00	1= Full Time	1=Dropped
0= Non-Hispanic	0= Regular	0= < 2.00	0= Part Time	0=Not Dropped

Figure 1. Converting the original one-record-per-person data to the person-period data set.

Since data on these students was collected on a semester basis, and since time-varying predictors are included, the discrete-time model is appropriate. Fitting of discrete-time hazard models requires that the data first be restructured into a person-period data set (Figure 1). Each individual under study has a number of separate records corresponding to the number of semesters in attendance. The dummy variables 'SEM_1-$SEM_1$2' are vectors created to denote the semester to which each line of the person-period data set corresponds. For each individual, SEM_1 takes on the value of 1 for Fall 1986, and all other dummies are set to 0. For individuals in attendance in Spring 1987, SEM_2 is coded 1, and so on for all semesters enrolled. Ethnicity (ETHNIC) and admission status (PROV) remain the same over the duration of enrollment, but full/part-time status (FPST) and grade point average (GPA) can vary from one semester to the next. A dichotomous dependent variable is created for each record which indicates whether the individual was still in attendance or was graduated, or left the university after that semester. For example, an individual whose outcomes (GONE) were coded 0, 0, 0, 0, 1 persisted through five semesters but did not return for

a sixth. An individual whose last record is coded 0 is either still enrolled or has graduated.

Because the outcome is dichotomous, logistic regression can be used to test hypotheses about hazards. The hazard model expresses the conditional probability that a student will drop out in a specified time period, given that he or she remained enrolled until that time. The model used to express the risk of dropping out for a provisional student is:

$$\text{logit } h(t) = [d_1 + d_2S_2 + d_3S_3 + \ldots + d_{12}S_{12}] + B_1\text{PROV}.$$

The estimate of B_1 quantifies the relationship between the individual's admission status and his risk profile. The logistic regression parameters d_2 through d_{12} measure deviations of the baseline hazard from an initial value of d_1. The first indicator is omitted in order to prevent linear redundancy (Singer & Willett, 1991).

The person-period data set created for this study was analyzed with a SAS program using logistic regression and adapted from code given by Willett & Singer (1991a) which includes plots for displaying fitted hazard and survival functions.

The survival function for the entire sample is computed first, showing the probability of remaining in ("surviving") school across 12 semesters (Figure 2.) By examining the slope of this profile, we can see that the drop is steepest during the first year. The median lifetime of this cohort is between three and four semesters. At the end of the observation period,

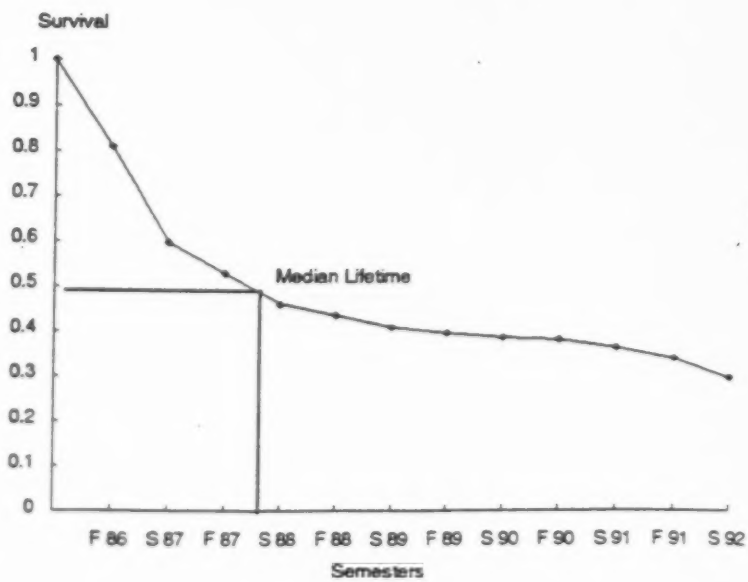


Figure 2. Baseline Survival Function

about 30% of the cohort has either graduated or is still enrolled.

The baseline hazard (Figure 3) describes the distribution of risk across time. The highest risk is after the Spring 1987 semester, the end of the first year. Thereafter, risk declines for the fall semesters but rises slightly for the springs, at the end of each academic year. By the end of fall 1990, four-and-a-half years after entry, many in the cohort have graduated. For those who have not, the risk of dropping out begins to rise again.

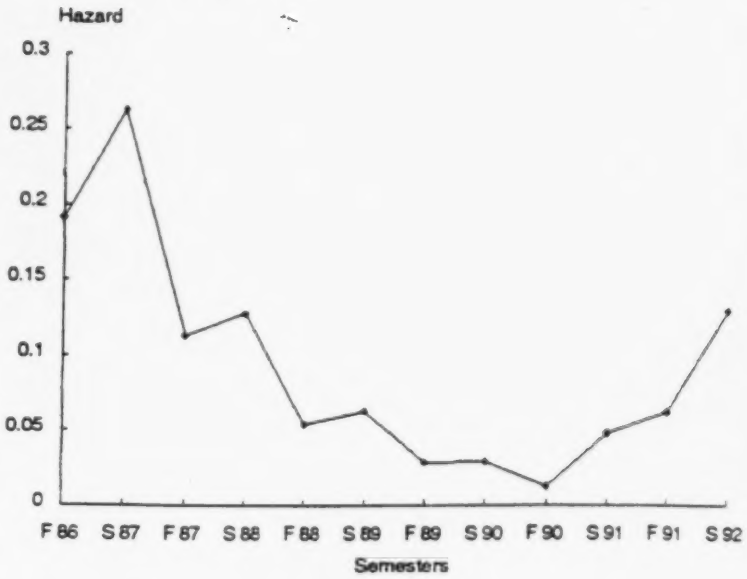


Figure 3. Baseline Hazard Function

Having described the sample as a whole, the next step in a survival analysis is to investigate the predictors chosen for the study, both as main effects and with interactions. Examining the risk profiles of provisional vs. regularly-admitted students in Figure 4 reveals the elevated risk of provisionally-admitted students in the first year,

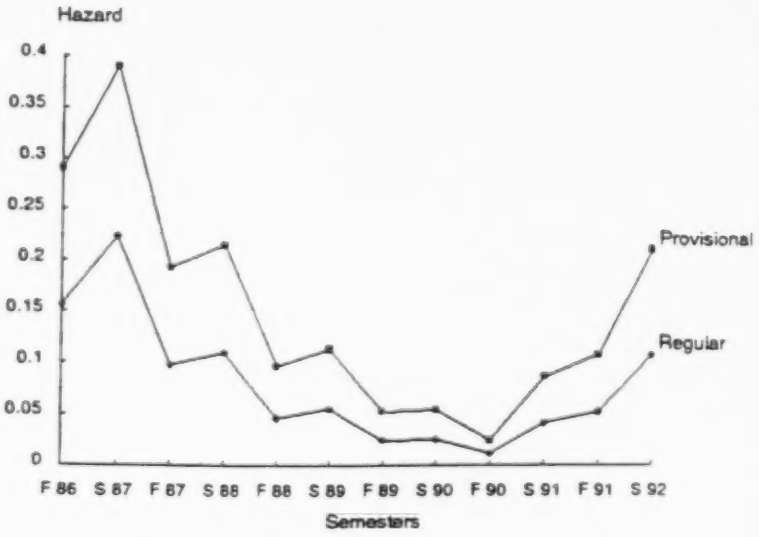


Figure 4. Hazard rates of provisionally-admitted vs. regular-admit students

and a substantial diminution of that risk by the end of the second year. The hazard function of any predictors can be compared against the baseline hazard; the pattern will be either magnified or diminished, depending on the group's overall risk profile.

When the effect of one predictor on an outcome varies with levels of another predictor, the predictors are said to interact. Creating an interaction term from any set of predictors allows investigation of these interaction effects on risk. Figure 5 shows the interaction of one time-invariant predictor, ethnicity, with academic success, which was measured by each semester's GPA. The hazard of dropping out for students who maintain a GPA of 2.0 or better is understandably low, although Anglo students show an elevated risk after the second semester, presumably due to transferring out. Even for those students in good academic standing, however, attrition increases after the fall 1990 semester. Naturally, dropout risk is highest for those students whose GPA's are below 2.0. The profile is practically identical for Hispanic and Anglo students.

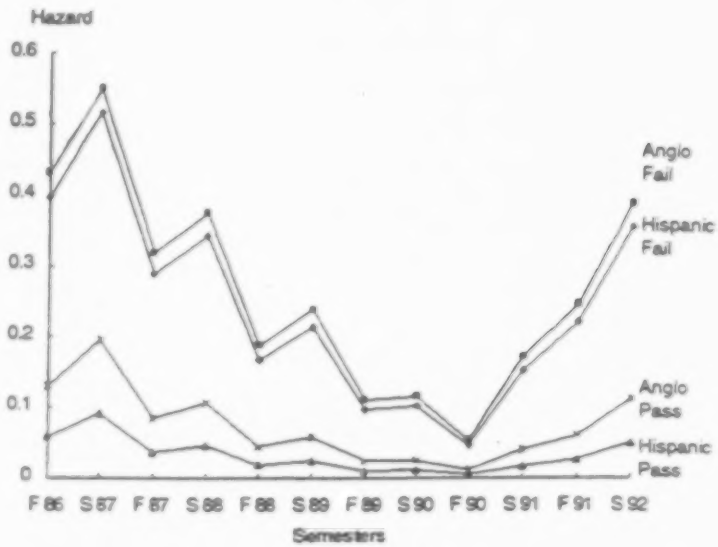


Figure 5. Interactions between ethnicity and GPA.

A predictor's effect on hazard can vary with time as well as with another predictor. The effect of being provisionally-admitted, for example, diminishes with time, as illustrated in Figure 6. The gap between the provisional and regular-admit group is widest when the predictor most affects risk. In this case, that effect exerts itself most prominently after the second semester, by which time provisional students must comply

with requirements to remove provisional status. The effect of provisional standing is completely erased in the third semester, but exerts itself again by the end of the second year. Figure 6 can be considered an exaggeration of the differences in elevation of the provisional and regular admit groups shown in Figure 4. That is, if we suspect that the distance at all points in time between these two groups is not a constant, introducing the interaction with time confirms that the proportional hazards assumption has been violated.

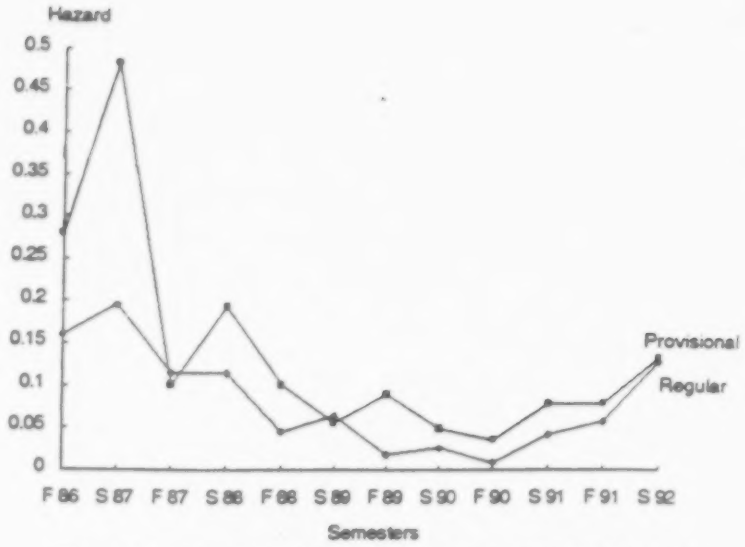


Figure 6. Interaction between provisional status and time.

Graphs are a necessary and informative initial step in survival analysis, but they must be supported by documentation of parameter estimates, standard errors, and tests of significance. The output given by logistic regression is summarized in Table 1. Chi-square statistics associated with the parameter estimates indicate significant effects. Simply tallying up all significant effects, however, does not really get to the essence of the relationship between the predictors and risk. In multiple regression, the R^2 yields a percent of variance attributable to the predictors. In logistic regression, the log-odds of occurrence of an event can be computed from a logit transformation of the parameter estimate. Happily, this transformation is given by the 'odds-ratio' output in SAS. These are multipliers of, or percentage increases in the odds of an event. We conclude, for example, that provisional students are 2.21 times more likely to drop out

Table 1

Estimates for Logit Models Predicting the Probability of Dropout
6,304 Person-Period Records

Predictor Variables	Parameter Estimates	Chi-square	Odds Ratio	-2 Log Likelihood	df
Main Effects					
PROV	0.793	78.29**	2.21	4072.89	12
ETHN	0.359	17.71**	1.43	4129.48	12
FPST	1.323	217.52**	3.75	3940.50	12
GPA	2.060	545.88**	7.85	3562.56	12
Interactions with Time					
PROV*SEM	0.714	19.71**	2.04	4044.01	23
ETHN*SEM	0.115	0.51	1.12	4114.23	23
FPST*SEM	1.585	88.57**	4.88	3919.63	23
GPA *SEM	2.199	160.18**	9.03	3524.54	23
Interactions among Predictors					
PROV*FPST	0.613	10.03*	1.85	3877.15	14
ETHN*GPA	0.744	16.14**	2.10	3518.83	14

* $p<.01$

** $p<.001$

as regular-admit students. Part-time students are 3.75 times more likely to drop out, and so on. These describe main effects, but when interactions are introduced, we can test whether the hazard rate for certain groups varies with time or with other predictors. The test statistic is computed from the difference in the log likelihood statistics given in the output using their associated degrees of freedom. For example, to compare the main effects model for provisional students with the interaction with time model, compute (4072.89 - 4044.89) = 28.88, df = (23 - 12) = 11, $\chi^2 > 24.72$, $p<.01$). Retaining the significant interaction with time term, we now conclude that provisional students are 2.04 times more likely to drop out after adjusting for semester effects.

In sum, by applying survival analysis to this retention data set, we have learned that:

1) The greatest risk of dropout for all students is during the first year, particularly after the second semester. After four-and-a-half years, continuously-enrolled students who have not graduated begin to exhibit elevated risks. This is true even of students in good academic standing, who perhaps have not focused on a particular major and become discouraged.
2) Provisional students are more than twice as likely to drop out, especially after the first year. Although they continue to be at higher risk than regular-admit students throughout their enrollment, this effect diminishes greatly after the second year.
3) Part-time students are almost four times more likely to drop out than full-time students. Again, this effect is more pronounced during the first four semesters of enrollment. Once they become more invested in their education, students can begin to attend part-time with lower risk of dropping out.
4) Although Hispanic students have a slightly lower risk of dropping out, there is little practical difference between Hispanic and white, non-Hispanic students in their risk profiles. The exception is white students in good academic standing after the second semester, whose elevated risk for "dropping out" is probably the result of transferring to other four-year schools.
5) The main reason for dropping out is academic failure. Overall, students in good academic standing have a relatively low risk profile.
6) Three of the predictors used, provisional status, full- or part-time status, and grade point average, exert different effects on the risk of dropping out at different times. It is riskier to be a provisional student at the end of the first year of enrollment. It is riskier to be a part-time student during the first semester than at other times.

This example of survival analysis used simple predictors, behaving quite predictably, to illustrate the application of this methodology to a reten-

tion data set. Extensions of these methods, using other predictors, easily come to mind. Survival analysis is a promising tool for institutional researchers who are interested in going beyond graduation rates to a real understanding of the factors which affect student enrollment and success.

References

Allison, Paul D. (1984). Event History Analysis: Regression for Longitudinal Event Data. Newbury Park, CA.: Sage Publications.

Hosmer, David W. & Lemeshow, Stanley (1989). Applied Logistic Regression. New York: John Wiley & Sons.

Mensch, Barbara S. & Kandel, Denise B. (1988). Dropping out of high school and drug involvement. Sociology of Education, 61, 95-113.

Murdnane, Richard J., Singer, Judith D. & Willett, John B. (1988). The career paths of teachers: Implications for teacher supply and methodological lessons for research. Educational Researcher, 17, 22-30.

Rosenfeld, Rachel A. & Jones, Jo Ann (1987). Patterns and effects of geographic mobility for academic men and women. Journal of Higher Education, 58, 493-515.

Singer, Judith D. & Willett, John B. (1991). Modeling the days of our lives: Using survival analysis when designing longitudinal studies of duration and timing of events. Psychological Bulletin, 110, 268-290.

Willett, John B. & Singer, Judith D. (1988). Doing data analysis with proportional hazards models: Model building, interpretation and diagnosis. ERIC Document Reproduction Service No. ED 293 899.

Willett, John B. & Singer, Judith D. (1991a). How long did it take? Using survival analysis in educational and psychological research. In L. Collins and J. Horn (Eds.). Best Methods for the Analysis of Change: Recent Advances, Unanswered Questions, Future Directions (pp. 310-327). Washington DC: American Psychological Association.

Willett, John B. and Singer, Judith D. (1991b). From whether to when: New methods for studying student dropout and teacher attrition. Review of Educational Research, 61, 407-450.

Yamaguchi, Kazuo (1991). Event History Analysis. Newbury Park, CA: Sage Publications.